Price $6.00

HERPETOFAUNA

Volume 23 Number 2 December 1993

An albino olive python, *Liasis olivaceus*, from the Darwin area, Northern Territory. A herpetological note on this animal appears in this issue. (photo: G. Bedford)

Morelia carinata the Rough-scaled python photographed in life at Prince Frederick Harbour Western Australia. A paper describing the finding of this, the third specimen located of the species, is the subject of a paper in this issue. (photo: J. Weigel)

NOTES TO CONTRIBUTORS

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A RECORD OF A THIRD SPECIMEN OF THE ROUGH-SCALED PYTHON *MORELIA CARINATA*

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In June 1993, we visited the Prince Frederick Harbour, in the northern Kimberley region of Western Australia for 13 days (4-16 June inclusive). One of us (John) had previously made numerous trips to other remote parts of the Kimberley, observing and photographing many of the endemic reptile and amphibian species, a primary goal being to photograph the rough-scaled python *Morelia carinata*, in life, for the first time ever. The species was described in 1981 from a single 2m long specimen collected from the Mitchell River Falls area in 1976, during a fauna survey by the Western Australian Museum (Smith, 1981). The only subsequent specimen known was 1.2m long when collected in 1987, also by a team from the Western Australian Museum, from a small patch of monsoon rainforest at the mouth of the Hunter River in Prince Frederick Harbour. Both specimens were initially thought to be carpet pythons *Morelia spilota*, and were sacrificed for collection purposes before being photographed.

It was our intention to explore various patches of monsoonal rainforest along the mouth of the Hunter River and its tributaries, primarily by foot, and with the assistance of two small (2m) inflatable rubber dinghies. We helicoptered into the region from an outlying Kimberley cattle station, alighting on a small salt flat, having arranged for a rendezvous with the helicopter 12 days later at another salt flat, 15 kilometres upstream.

The area is dominated by impressive sandstone escarpments, gorges and massive boulder piles. A band of mangrove forest hugs most of the shoreline, and between our drop-off position and the harbour it is approximately 50 metres wide. The topography of the harbour environs proved to be far more radical and imposing than we had anticipated, and we soon concluded that hiking along our pre-determined route to the pick-up point would not be possible without widely detouring inland.

Due to a leak in our primary water carrying container, which apparently occurred during the loading or unloading of the helicopter, we began our expedition with a total supply of only 15 litres of fresh water, about half the quantity we had anticipated. In view of the impending water shortage, we decided to launch the two dinghies with the aim of working our way upstream to the nearest substantial tributary of the Hunter River - an unnamed creek which forms a waterfall two kilometres above where it joins the Hunter. Our topographical maps indicated permanent fresh water billabongs above and just below the falls. Another advantage in speeding our journey directly to the creek was its close proximity to our rendezvous point. We would safely concentrate our field work along the creek until our helicopter departure.

At mid-morning on day two, we prepared to launch from the outer edge of the mangrove. The thick, foul-smelling mud and tangled mesh of the criss-crossing roots of "spider" mangrove trees *Rhizophora sp.* made movement very difficult. We were timing our departure to coincide with the arrival of the huge incoming tide (.2m low, 6.2m high) to assist in our journey upstream. As the water flooded in to cover the mangrove forest floor, the trees were being submerged at a rate of more than a metre per hour. The two dinghies were tied end to end and balanced on some of the highest of the arching prop roots of surrounding mangrove trees approximately 1.5 metres high in anticipation of the rising water. Our equipment, likewise, was wedged amongst the maze of criss-crossing roots. As the dinghies began to lift free, we transferred the equipment which included back packs, camera equipment and water receptacles into the trailing "supply" dinghy. As we prepared to squeeze into the lead boat to begin the long paddle to our intended destination, only a few roots and a couple of nearby oyster-clad boulders continued to protrude

above the water line. One last glance before boarding revealed the awful thing that we had feared most - the emerged head of a large saltwater crocodile. It, like us, was at the very edge of the mangroves - but about 20 metres downstream, to the left of our dinghies, which were pointing towards the middle of the harbour. The crocodile submerged as silently and suddenly as it had appeared. After two minutes it re-surfaced, fortunately no closer than where we had just seen it. Again, after a couple of minutes afloat, it sank quietly from view. It repeated this pattern of surfacing and submerging over a 10-15 minutes period. Efforts to frighten it away by throwing broken branches, splashing and waving hats appeared to have no effect. The water level was rising very quickly, the small choppy waves wetting our feet where we stood: Trent on the very highest arches of the remaining mangrove roots, John on an adjacent boulder. We had to make the extremely difficult choice between wading through deep water and climbing over the tangled root systems towards the rocky shoreline some 50 metres away, or to take our chances with the rubber dinghies in the open water, possibly with our curious visitor close at hand. If we were to retreat to the safety of the shoreline, we would only be able to salvage a minimum amount of equipment, possibly only the water containers. We would then be faced with the formidable task of an overland trek to join the helicopter some twelve days later. We doubted that our water reserves would see us through such a journey, which would require considerably more walking, climbing and crawling over the broken sandstone escarpment country than had been initially planned. We chose to launch - a decision we were to almost immediately regret, since as soon as Trent had left his perch atop an arching mangrove root to position himself in the lead boat, the crocodile, which had been submerged for a bit less than the usual two to three minutes, re-emerged - not, as expected, where it had bobbed up and down five or six times already, but on the other side of the lead dinghy within which Trent was now stranded, paddle in hand. The crocodile had passed unnoticed beneath the dinghy. The very top of its head was motionlessly poised only a metre beyond Trent with much of its body directly beneath the small inflated craft. John stood on a rock about 1.5 metres in front of the crocodile where he had just loaded the last of the equipment onto the trailing dinghy. Neither of us moved.

The crocodile looked to be about 3.5 metres long. It slowly moved forward towards the rock upon which John was standing, his feet about 30 cm above the current water level. Miraculously, after edging slowly to within a few centimetres of the rock, it again submerged. As the detail of its form faded from view, John sprinted across the tops of the few remaining roots, around the crocodile, behind the trailing dinghy and eased into the lead dinghy there he grabbed a paddle and joined Trent in a frenzy of paddling. Our first concern was to avoid grazing against the submerging boulders, as they were covered with sharp oyster shells - John had gashed both his hands after slipping during the eventful activities of the previous minutes. We knew that a puncture to either dinghy would mean certain disaster. The boats glided free of the mangrove forest with surprising ease, and when, after a few minutes of intense paddling, we were able to look back over the 200 metres or so to the fringe of mangroves, we were unable to see any sign of the crocodile.

We continued paddling with great inspiration until reaching the middle of the harbour, about a kilometre from the shore, at which time we floated freely for a few minutes, taking stock of our situation. It seemed hardly believable that we were apparently to survive the events of the previous hour. From there we began our long, steady journey upstream. With four hours of tide assisted current, followed by another two hours of fairly neutral current during high tide, we paddled relentlessly, enduring muscle cramps and extreme fatigue. We travelled approximately 12 kilometres to eventually reach a lone rocky point that protruded from the mangroves at the mouth of the unnamed creek we were seeking. In its lower reaches, the creek is a traversing, bending estuary about 20 metres wide, bordered by steep muddy banks and a narrow band of mangroves - typical saltwater crocodile country. We decided to leave the dinghies behind and carry on by foot. After a bit of fishing, relaxing and a night of sound sleep, we awoke in good

spirits to begin what we anticipated would be a four hour hike. We deflated the dinghies and secreted them along with a proportion of our equipment under a rocky over-hang, strapped on our back packs, and set off for our destination - the upper freshwater reaches of the creek. We planned to reclaim our deposited equipment towards the end of our stay in the Kimberley, as the planned helicopter pick-up location was only a kilometre away, in the opposite (south west) direction. It took eight hours to reach our goal, hiking parallel to the creek over very rough stony country, through a grassy valley, and finally turning sharply to the left to join the creek, well upstream of the waterfall indicated on our maps. The creek consisted of numerous large, deep billabongs, connected by a narrow, shallow flow of fresh water. We spent the next six days exploring the creek and nearby environs. The nature of this area - its geology, flora and fauna, is very similar to that associated with the Mitchell Falls area some 30 kilometres to the northeast (Shea, Weigel, *et al*, 1988). The weather, as usual for the Kimberleys during this time of the year, was cool with an approximate night time low temperature of 16°C and day time highs of about 28°C. The skies were cloudless and the conditions very dry and breezy. The mild conditions allowed good opportunities for day time field work, though evening temperatures dropped fairly abruptly, and reptile and amphibian activity substantially waned between one and two hours after sunset. Night searching was facilitated by the use of head lamps - fitted with high performance halogen globes enabling the detection of the reflective eye shine present in most nocturnal animals. Typical Kimberley endemics located included the fringe-toed gecko *(Oedura filicipoda)*, the giant cave gecko *(Pseudothecadactylus lindneri cavaticus)*, McMillan's gecko *(Diplodactylus mcmillani)* and the superb dragon *Diporiphora superba*. We were fortunate enough to observe several small-scaled bearded dragons *Pogona microlepidotus*, which in behaviour appeared to be quite unlike other "bearded" dragon species, scurrying with great speed and agility across sandstone slabs and the tops of boulders, seeking refuge in shallow crevices - rather similar in these respects to the ornate dragon - *Ctenophorus ornatus* of the stony country of southwest Western Australia. Numerous small freshwater crocodiles *Crocodylus johnstoni* were observed in the larger billabongs, but, thankfully, no saltwater crocodiles were encountered.

Finally, the decision was made to explore the lower reaches of the creek - below the waterfall in particular. Our maps indicated a deep gorge associated with the falls which we hoped would contain at least a small patch of monsoonal rainforest, a very productive Kimberley habitat type that we had yet to encounter on our trip. We followed our way down along the shallow flowing creek. This was early dry season, and it appeared likely that the flow of the creek would cease during the coming months. The creek drops away quite suddenly, plummeting 60 metres into a black, crater-shaped pool approximately 40 metres wide. The view downstream was awesome. A deep gorge extended for more than a kilometre - the sheer red cliffs standing over 120 metres high. The floor of the mini canyon was largely obscured from view by the upper canopy of monsoonal rainforest. The effect was enhanced by the presence of a flock of white Torres Strait pigeons circling some 50 metres directly below us. Beyond the falls the creek meandered amongst boulders of all size disappearing beneath the rainforest in places. A transition zone, about two kilometres downstream, could be easily identified where dark clear fresh water was diluted into the yellow muddy estuary that leads a kilometre or so to the Hunter River. The position of the falls is approximately 15°00'S, 125°30'E.

On June 12 we worked our way along the gorge, skirting the edge of the cliff on the southern side of the gorge beyond the fall, where we were eventually able to descend along a steep ravine to the bottom of the gorge. The view from below was as breath-taking as it was from above. The imposing cliffs stood about 100 metres apart, framing the narrow stretch of blue sky between them. The impact for us was heightened by the feeling that we were almost certainly the first non-Aboriginal visitors to the gorge. We were hot and tired, having spent most of the day on foot and decided to set up camp, do a bit of fishing (which revealed an unlimited supply of large, tasty sooty grunters), have an early evening meal and prepare for our first night

of field work in the gorge. We left camp at sunset - moving upstream, on the northern side of the creek, where the largest patches of monsoonal rainforest hugged the northern wall of the canyon, and included many very large, fruiting trees. An assortment of native mammals including the endemic scaly-tailed possum *Wyulda squamicaudata* were later to be observed feeding from the trees and amongst the fallen fruit (lilli pillies, small figs). Trent was working his way along the creek, John was transversing back and forth through the rainforest from the creek to the northern wall of the gorge some 40 metres away searching for tell-tale reflective eye shine, periodically rejoining Trent. After about the third jaunt into the dense scrub, upon returning to a boulder strewn section of the creek about a half a kilometre below the falls, Trent made his announcement: "A Children's python! ..." "No ..., it's a carpet python! ..." "No! It's a rough-scale python!". The narrow beam of Trent's head lamp was directed onto the top of a medium size boulder, approximately 2 metres tall and several metres wide, some 5 metres or so from the creek's edge. Shrubs and trees surrounded the scene. There, in the light of the head lamp, coiled motionless, was a juvenile rough-scaled python *Morelia carinata*. It was a great moment for both of us and alternative joyous howls and photographic flashes bounced across the walls of the gorge. The snake was about 80 centimetres long, its beautiful pattern of mottled cream and buff colours being somewhat similar, as alluded to by Trent, to the inland "Children's" python *Bothrochilus stimsoni*. The rough texture of its skin was quite fine and abrasive - not unlike shark skin (see Figure 1).

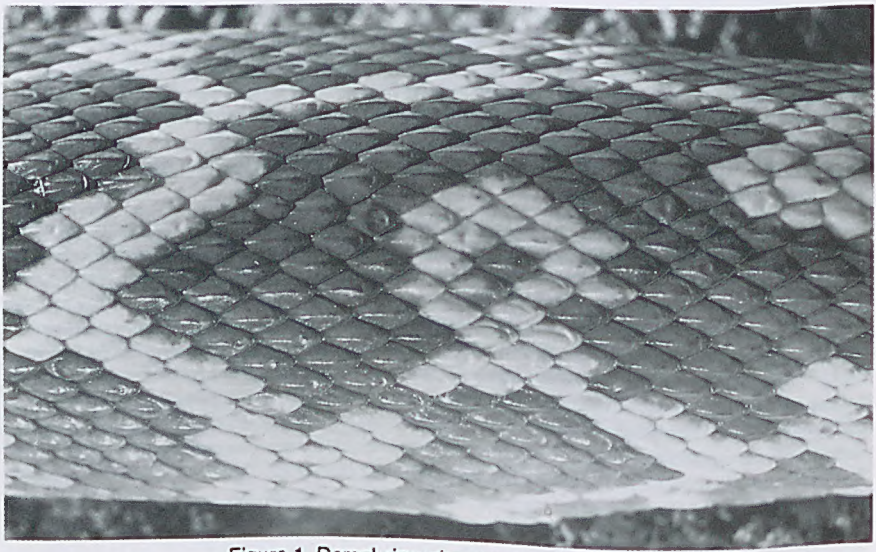

Figure 1. Dorsal view showing keeled scales.

Our hopes of finding an adult rough-scaled python waned during the following days as unseasonal, overcast conditions and patchy rains appeared to halt most reptile activities. We made our way to the pre-arranged pick-up location, arriving a day early - which provided an opportunity to carry out a search for *Homalopsid* water snakes. One Gray's mangrove snake *Myron richardsonii*, a first for both of us was found, and nearby, much to our chagrin, the skull of a saltwater crocodile was discovered embedded in the thick estuarine mud.

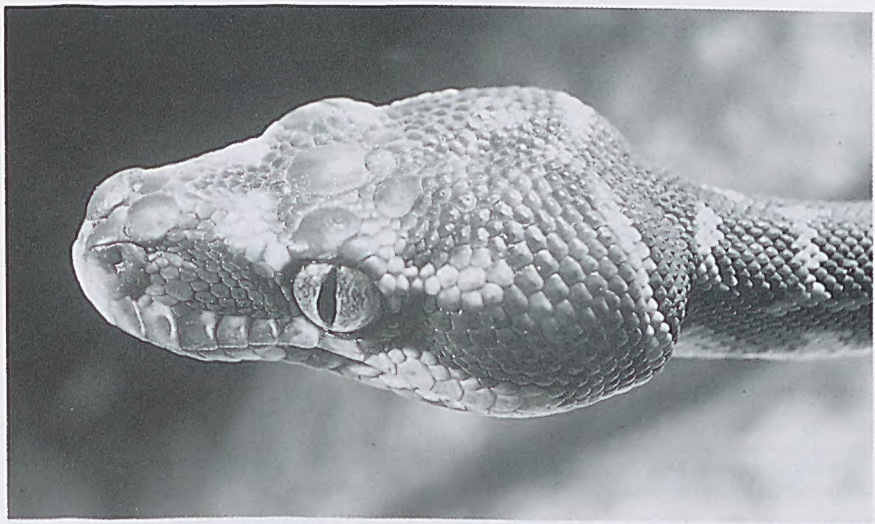

Figure 2. Head of *Morelia carinata.*

At 8 am on 16th June, the helicopter returned, on time, ending our eventful visit to the Prince Frederick Harbour. During our stay we found and identified the following species of reptiles:

Crenadactylus ocellatus naso, Diplodactylus mcmillani, Gehyra occidentalis, G.xenopus, Heteronotia spelea, Oedura filicipoda, O.gracilis, Pseudothecadactylus lindneri cavaticus, Diporiphora bennettii, D.superba, Carlia amax, C.johnstonei, C.triacantha, Cryptoblepharus plagiocephalus, Ctenotus inornatus, Morethia ruficauda ruficauda, Pogona microlepidotus, Varanus glauerti, V.glebopalma, V.mertensi, Boiga irregularis, Myron richardsoni, Liasis olivaceus, Morelia carinata, Crocodylus johnstoni, C.porosus. Only a few identifiable frogs were found, including *Litora cavernicola, L.splendida and L.coplandi.*

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MATING BEHAVIOUR OF *LITORIA LESUEURI* (ANURA: HYLIDAE)

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ABSTRACT

Litoria lesueuri (Dumeril and Bibron 1841) is a medium sized ground dwelling Hylid frog common over much of eastern Australia (Moore 1961). This frog is a fawn to brown colour with males having a distinct yellow wash, particularly at night during the breeding season. Females are larger than males (Moore 1961).

Male *Litoria lesueuri* establish themselves at breeding sites, ponds or creeks, some time before females arrive. Observations in October and November 1992 showed that the males find and defend territories, the most suitable calling sites. The males of this species exhibit vigorous breeding behaviour.

INTRODUCTION

This paper was put together after observations on a field trip to Ourimbah Creek (lat 33°22'S, long 151°21'E), approximately 60 kilometres north of Sydney on 31/10/92.

Whilst randomly searching in the forest, approximately 12 kilometres along Ourimbah Creek Road, the author was drawn down to the creek by the calls of many *Litoria lesueuri*. A back creek was discovered flowing in a North-South direction, with a large slow flowing section and a dam made from debris. The flood banks on either side of the creek were approximately 2 metres high.

The behaviour of the frogs led to further trips to the site as well as another, different type of site (8.5 kilometres along the same road) on 3/11/92, 9/12/92 and 3/1/93.

Materials and Methods

Distances between frogs were taken with measuring tape and individual frogs were measured, while still in plastic bags to avoid stress, with a plastic transparent ruler. Weights were taken on an ARLEC portable battery operated scale which unfortunately only weighs to the nearest gram. Site A was relocated each time by using land marks such as trees on the forest track, and the flood banks. Site B, 8.5 kilometres along Ourimbah Creek Road was located using odometre readings.

Animals held in captivity for behavioural observations were housed in a 900 x 360 x 450 mm glass aquarium which was landscaped with rocks, logs and live plants, and approximately 100mm of static water.

OBSERVATIONS

On several field trips in late October and early November 1992, many male *Litoria lesueuri* were observed at two different types of breeding sites. Site A was a shallow, slow flowing part of a creek just below a dam formed by debris (fig. 1), and site B was a semi-permanent pond at the end of a paddock backing on to a wooded hillside.

The male frogs had positioned themselves around the breeding sites at relatively even intervals. At site A the average number of frogs was 15 with an average distance of 900mm between them, while at site B the average number of frogs was 25 with an average distance of 1500mm. At site A the calling sites were close to the waters edge, less than 60mm, but raised on clumps of soil or piles of debris. At site B the calling males were further away from the waters edge, up to 1.5 metres, also tending to be on raised areas of ground. One frog at site B was found calling from the top of a fence post, 1 metre high and 1.5 metres up the bank into the woodland. The

frogs called in an upright position. This is in contrast to Moore (1961) who records these frogs as resting in depressions with a nose down attitude.

Territorial behaviour was observed at both sites but was most vigorous at site A where limited calling sites were available. This behaviour was not a physical struggle, but a calling battle. A frog would turn to face an intruding male, getting even as close as to touch the other's snout, and calling vigorously. The intruder did not call back as vigorously as the resident frog. The calls of the intruder were given less often than the resident frog and were less intense. When the defence or threat worked, the loser would leap away into the water, emerging on the opposite side of the creek and start again with another frog. Males at site B were never observed to get that close to one another, averaging a distance of .5 metres before the loser leaped away.

Observations of a captive specimen from site A where calling sites were limited, showed that he would amplex with any frog larger than himself which came close to him, except another male *Litoria lesueuri*. In this case, the frog ignored a gravid female *Litoria lesueuri*. He would call very vigorously for several minutes at a time. When he did observe another frog larger than himself, he would at first stop calling then give a second call type, quite short and of a higher pitch, and then leap at his target. During the first night of this behaviour this one male ignored a female *Litoria lesueuri* and continually amplexed with any of 3 large *Litoria caerulea* also in the tank. The sex of these frogs did not seem to bother him as he continually amplexed with each one time and time again.

It was quite difficult for him to stay on these frogs as they were quite large, all 3 being over 100mm SVL and he had to spread his forearms wide across their backs to hang on.

Each time this frog amplexed, or just prior to amplex, he would change colour to a bright lemon yellow.

At 0930 hours the following morning, although still in amplex, he had returned to normal colouration and was removed from the back of one of the green tree frogs and placed in a smaller container with a female of his species. As soon as he was placed in this container he started to call vigorously, then repeated his quieter call and leaped 200mm across the tank to amplex with the female. She was not responsive and gave a call which was squeaky, thin and high pitched. The male remained amplexed with the female all that day, the next night and until 1100 hours on the following day. It was only after darkness that the male underwent the colour change to yellow. The female continued with her call 2 or 3 times an hour and as no oviposition occurred, it was assumed that this call was a release call. It has been observed, from captive observations, that the male release call is different to the female release call (pers. obs.).

EGG LAYING AND FERTILISATION

An amplexed pair held in captivity from site B deposited approximately 500 eggs on the morning of the 10th December, 1992. The pair were located the previous night, and at time of capture the male was in bright yellow colouration, however, after transportation, he returned to his usual colour, even during amplexus and deposition.

Oviposition was quite rapid occurring between 1020 and 1100 in the morning. The eggs were laid in two main clumps with some smaller deposits around them. Figure 2 shows the shape and position of the main egg mass, which was the first to be laid. The main clump was laid in a sausage shape of densely packed eggs, appearing soon after laying to be almost solid. As the eggs expanded in the water, individual eggs could be made out. This clump was laid across the ridge of a sandstone rock that partly broke the surface of the water, so that some eggs in the mass were above water level. It took 2 to 3 days for any significant shape change to occur. The other main clump was laid behind this rock and appeared as a large lump, as if the sausage shape had been distorted by being laid on top of itself. The pair were briefly disturbed just prior to laying this second clump.

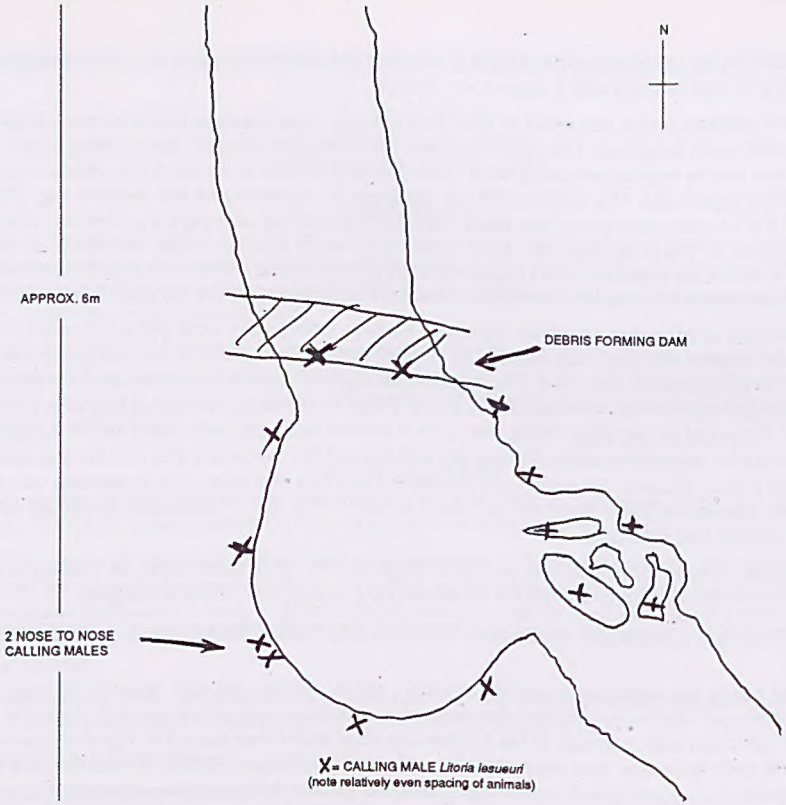

Figure 1. Spacing of frogs at breeding site

The disturbance seems likely to have caused them to release the clutch, as none of these, or any other eggs outside clump no. 1 were fertilized.

DISCUSSION

Observations in the field revealed many male *Litoria lesueuri* calling on several nights, but an almost complete lack of females. Over the four main field trips, only 2 females (not including the female from the amplexed pair) were located. One of these females was gravid, but not heavily so, and the other escaped before condition could be checked, sex being determined by size. Other females were seen, but away from breeding sites, probably foraging for food.

Apart from size, *Litoria lesueuri* shows sexual dimorphism in that males, at least in breeding condition, show a distinct yellow wash, changing to bright yellow all over in peak sexual activity. The average size of male frogs found was approximately 45mm with a weight (to the gram) of 6 grams, whereas females averaged at 65mm with a weight of 12 grams. Mattinson (1987) states that colour in frogs is generated by 3 layers of cells in the epidermis. The outer cells (Chromatophores) give rise to black, brown and reds, the mid cells (Xanthophores) produce yellow, orange and also some reds and the lower cells (Iridiphores) do not produce colour but reflect light. Combinations of these cells reacting to hormonal changes produce the colour of frog's skin.

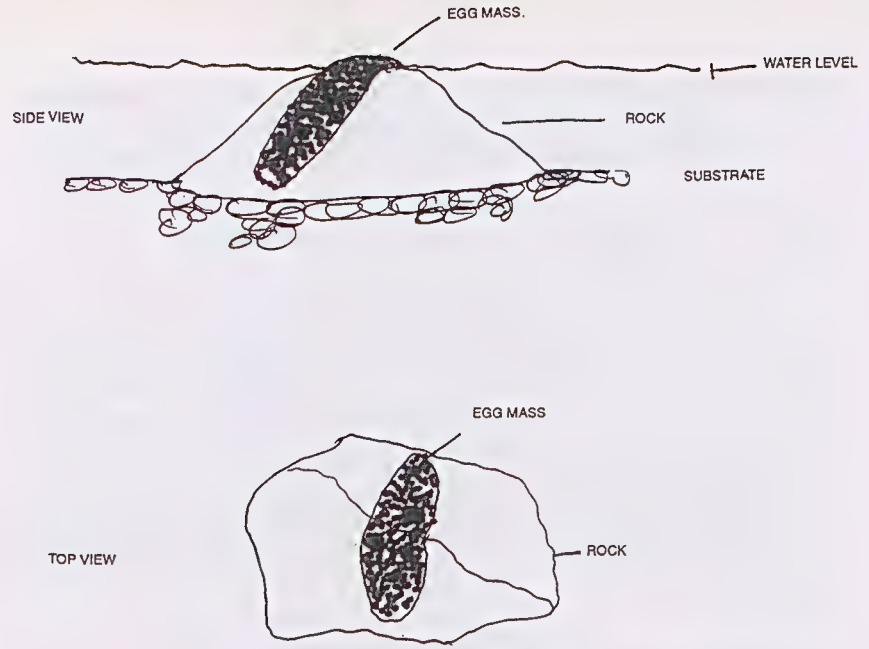

Figure 2. Position of egg mass

It would seem that hormonal changes associated with sexual activity produce the yellow colour seen in male *Litoria lesueuri.* This may be sex determined as females of this species do not demonstrate this colour change.

Males of *Litoria peroni* and *Litoria dentata* with yellow washes in breeding condition, as well as a calling lemon yellow *Litoria tyleri* have been observed (pers. obs.).

Captive males showed active breeding behaviour generally in response to larger frogs. The male from the amplexed pair repeated the behaviour pattern demonstrated by the first male (i.e. vigorous calling and frequent amplex with larger frogs) after releasing the female.

Based on observations, both in the wild and in captivity, it would appear that calling males is not sufficient stimuli in itself for females to be drawn to calling sites to breed.

Much of the behaviour noted in captivity, including egg laying, took place during daylight hours. This species is known for daytime activity, particularly calling (Firth & Firth, 1987).

This paper was prepared as part of the Advanced Herpetological Techniques course run by Harald Ehmann and Sydney Technical College.

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OBSERVATIONS OF INTRA AND INTERSPECIFIC AGGRESSION AND POSSIBLE MATING HIERARCHY IN THE NORTHERN CHILDRENS PYTHON *(LIASIS CHILDRENI)*

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Data on aggression and mating strategy were collected over the 1992 and 1993 mating seasons (July and August). During the 1992 mating period four male Northern Children's pythons *(Liasis childreni)* were collected at night on roads around Darwin, NT. These animals were maintained in a large glass fronted wooden cage (1500mm x 800mm x 600mm). Two long term captive female Children's pythons were maintained in individual cages, separate from both each other and the male pythons throughout most of the year. One male Stimson's python *(Liasis stimsoni)* was obtained from the Tanami Desert. Animals used during the 1993 breeding season included 2 female Northern Children's pythons, 3 male Northern Children's pythons, 1 male Stimson's Python and 2 female Stimson's pythons. All animals used throughout the study were reproductive adult animals (Shine, 1991). The pythons were fed laboratory mice and given water for one day each week.

1992 SEASON

A female Children's python was introduced into the cage with the four male *L.childreni* which had been kept together during the year. It was noticed that after placing the female in the male enclosure, the male snakes became 'excited' and began roaming the cage with an observed increase in the frequency and duration of tongue flicking. The males appeared to be following the trail of the female as the number of tongue flicks and tail twitching activity increased over the areas where the female had moved, similar to the response to sex pheromones exhibited by other reptiles (Bull, *et al*, 1993).

After a few minutes the activities of the female suggested that she also was 'excited' by the presence of the males as she began to twitch her tail and emit a clear liquid from the vent. All male animals tended to move their bodies over the female, this lasted for about half an hour before the largest of the males began wrestling with one of the other males. No biting was observed but the fighting was vigorous and lasted for ten minutes before these animals disentangled. The largest male went back to the female who was still beneath the remaining two males. The other male moved to an unoccupied corner of the cage and coiled up. Some hours later the largest male was seen in a wrestling duel with the smallest male python in the cage. Once again the fighting was quite vigorous however no biting was observed. The whole ritual was not watched, but later that day it was observed that all three smaller males were coiled together in a corner away from the largest male and the female. At 2030 on Sunday the second of August 1992, the largest male and the female were seen copulating. This mating lasted until 0600 the next morning (3rd of August). The largest male was removed at 0630 on the third of August, 1992. Early on the evening of the third of August all three remaining males were found to be again moving over the female as before. The female was also receptive, evident by the twitching of the tail. At no point during these observations did fighting occur among the three remaining males. Over the next week all males were seen to copulate with the female. The largest male was returned to the cage. It was seen that all three smaller males departed from the immediate vicinity of the female and again coiled in a corner. The largest male did not copulate with the female again. On Tuesday the 18th of August, the first female was removed from the cage and a second receptive female was placed in the cage. All four

males immediately became 'excited' by the new introduction, however, before any mating action had occurred another male python was introduced to the cage. This python was a Stimsons python *(Liasis stimsoni)*, a distinct species of comparable size to the largest male Childrens python.

It was found that this introduction immediately elicited a wrestling response by the largest male, but this time he began biting the new intruder. Because of the potential risk of harm to the Stimsons python it was removed. The next day when the largest male and the female had ceased copulation, the male was removed and replaced by the Stimsons python. Every time this python, which was larger than any of the three remaining pythons, went near the female it was either wrestled or bitten or both by one or more of the three Childrens pythons. All male Childrens pythons were seen to bite the Stimsons python. Although no serious wounds were inflicted, it was evident that it represented some sort of threat.

Again the Stimsons python was removed and the remaining three males began 'courting' the female again. After another male had copulated with the female, all three males were removed from the cage and replaced by the *L.stimsoni.* The female very rarely came in contact with the Stimsons python, and when it did it was clear that copulation was not intended, for the female would move swiftly to another part of the cage. The response by the *L.stimsoni* was one of escape, searching the cage for a way out. This final experiment was conducted a further three times over the next week. It was apparent that the female was receptive, for each time the male *L.childreni* were placed in the cage, the female would be found to copulate with one or more. When the male *L.stimsoni* was placed in the cage there was no reaction, which would suggest that this animal was not a compatible suitor.

1993 SEASON

The 1993 mating season saw a similar occurrence to that experienced in 1992 with the exception that no mating hierarchy was exhibited, however the whole experiment was conducted more in isolated pairs rather than as a group. As previously mentioned, all animals were kept separate during the year. Males were seen moving in their cages in early July so the introduction of females into the cages of males began in mid July. In an attempt to hybridise these species, a female *L.childreni* was introduced into the cage of the male *L.stimsoni.* Mating occurred almost immediately. Two separate female *L.stimsoni* were placed into the individual cages of male *L.childreni.* Mating occurred within a few hours in one pair and after about a week in the second pair. After it appeared that a successful mating had occurred another male *L.childreni* was placed into the cage of the female *L.stimsoni* and male *L.childreni.* It was observed that no aggressive behaviour occurred and after three days the second male *L.childreni* was removed and placed into the second cage of female *L.stimsoni* and male *L.childreni.* Again no aggressive behaviour was seen and all male *L.childreni* were removed from the female cages after about a week.

When the male *L.stimsoni* had lost some interest in the female *L.childreni* it was moved to the cage containing the second female *L.childreni.* Copulation commenced within a few hours and lasted until the next morning. That afternoon a male *L.childreni* was introduced into the cage and the behaviour of the female *L.childreni* changed markedly for she appeared to dissociate herself from the *L.stimsoni* male by moving to the corner of the cage opposite to him. It became interesting when the introduced male *L.childreni* started wrestling and biting the *L.stimsoni.* When this childrens python male was removed, the female then bit the male *L.stimsoni.* This process was repeated with the two other male *L.childreni.* They were placed on separate occasions in the cage with the female *L.childreni* and the male *L.stimsoni.* In all instances the female and the male *L.childreni* sought to escape the *L.stimsoni* and were prepared to bite him if he ventured too close. It appeared that the male *L.stimsoni* was not interested in mating after it had been bitten and the fighting began. It is interesting that no male *L.childreni* was seen to

successfully copulate with the female *L.childreni* when placed with her after the male *L.stimsoni* had mated with her.

When the male *L.stimsoni* was removed from the female *L.childreni* and placed in the cage with the male *L.childreni* and female *L.stimsoni* there did not appear to be any aggression. All three animals moved freely about the cage, however no mating was observed and it appeared that the interest in mating had subsided. Other male *L.childreni* were placed in this cage with the same result.

DISCUSSION

From these observations over two breeding seasons it appears that female Northern Childrens python *(Liasis childreni)* are prepared to mate with males of another species if a male of the same species is not forthcoming. This would go a long way to explain hybridisation zones which occur in the pythons in Australia (i.e. north coast of NSW for *Morelia s.spilota,* and *L.childreni* in the Barkley district). It also was evident that male Childrens pythons are prepared to defend a mate vigorously against conspecific and intraspecific competition. A hierarchy was not observed in the 1993 breeding season probably due to the nature of the experiment with animals being kept separate. Many of the observations were repeated and the findings also demonstrate that *L.stimsoni* is not as aggressive either toward its own species or to other species even in the competitive arena of reproduction and yet the Stimsons python is the most geographically diverse python in the Children python complex (Cogger, 1992).

ACKNOWLEDGMENTS

We would like to thank DPI & F at Berrimah for the donation of mice. CCNT supplied permit number DASC920044. Thanks to Keith Christian and Greg Fyfe for support and review of the manuscript.

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SNAKE FOOD

The Tasmanian Herpetological Society is resuming its offer of elvers to those in the herpetological community who are undertaking captive breeding/rearing projects.

Elvers (baby short finned eels) can be used as a food supply for neonate snakes that are too small to take day old pinky mice. They weigh 1 gram, have a diameter of 2-3mm and a length of about 4-5cm and are frozen.

The Tasmanian herpetological Society are providing the elvers at no charge, but you must meet the costs of freight and packaging.

If you are interested in obtaining this food supply please phone:
Dr Sue Woinarski on (003) 27 2466.

A NEWLY DISCOVERED OLD RECORD OF THE ENDANGERED STRIPED LEGLESS LIZARD, *DELMA IMPAR* (SQUAMATA: PYGOPODIDAE).

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The Striped Legless Lizard, *Delma impar* (Fischer, 1882), is a rare and apparently declining species inhabiting native grasslands on basaltic soils in Victoria and adjacent parts of South Australia, New South Wales and the Australian Capital Territory (Coulson, 1990). It is currently variously listed as "threatened", "vulnerable and rare", or "in need of special protection" in fauna protection legislation in Victoria, New South Wales and the Australian Capital Territory. While the conservation status and ecology of the species have been the subject of much recent and ongoing research in Victoria (Coulson, 1990) and the Australian Capital Territory (Williams & Kukolic, 1991; Osborne & Williams, 1992), the distribution and status of the species in New South Wales remain poorly defined. Kluge (1974) and Shea (1991) listed only single museum specimens from three New South Wales localities: Gilmore, near Tumut and 14.5km N. Batlow. Jenkins and Bartell (1980) list an additional two localities: Sutton and Tarcutta. Swan (1990) mapped all five New South Wales localities, all being from a small area to the north-west and west of the Australian Capital Territory. An additional record from Pokolbin, cited by Swan but not mapped, is apparently based on a misidentified *Delma plebeia* (G. Swan, *pers. comm.*).

In view of the paucity of records of this taxon, an old but recently confirmed record of the occurrence of this species from eastern-flowing drainages on the Monaro Tableland is worth noting. At the meeting of the Linnean Society of New South Wales on 29 August, 1888, a "Mr Deane exhibited ... a specimen of an apodal lizard *(Delma impar)* found by Mr. C.F. Price of Arable, near Cooma, where the species is said to be abundant in basaltic country; ... " (Anon, 1888). By itself, this record is of little value, as the identification occurred at a time when *Delma* systematics were poorly resolved, and only two of the sixteen species now known were recognised (Boulenger, 1885). However, a recently discovered specimen (R410) of *D.impar* in the collection of the Macleay Museum, University of Sydney bears the locality "Cooma N.S.W." and, despite the lack of any date or collector as confirmatory evidence, is possibly the specimen exhibited in 1888. The adult specimen (SVL 82mm), though faded, is readily identified as *D.impar* by the presence of fusion of the first supralabial to the nasal rostral to the nostril, and the characteristic dorsolateral body pattern.

The locality Arable near Cooma presumably refers to the former "Arable" station near Cooma (36°21'S 149°02'E), described by Whitworth (1866) as of 22,677 acres. This locality is over 100km south of the nearest record of *D.impar* and on the opposite side of the watershed to other New South Wales records.

Although the species was reported to be "abundant" in 1888, there have been no recent collections from the area to confirm the continuing existence of this population.

The discovery of this specimen provides yet another example of the value of historical collections in studying biodiversity (Ingram, 1991; Manning, 1991).

ACKNOWLEDGMENTS

I thank S. Norrington and Dr D.S. Horning of the Macleay Museum, University of Sydney, for their enthusiastic assistance during my examination of the collection in their care, and for their comments on the manuscript. A. Greer also commented on the manuscript while G. Swan assisted with literature.

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RAISING THE GREEN AND GOLD, OR SMOOTH SWAMP FROG *LITORIA AUREA* TO MATURITY IN CAPTIVITY

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In February 1992 the Australian Museum was presented with an adult female *L.aurea* from the NSW Central Coast. It was decided to keep her alive for a potential future breeding attempt as this was the first living specimen most of us had seen for nearly ten years.

She was almost entirely green and settled in well, feeding on juvenile mice, *Periplaneta spp.* cockroaches and mealworms. She was kept in an aquarium 36cm x 22cm x 28cm high with a pebble substrate, some *Chlorophytum* and a dog's drinking bowl 16cm x 7cm deep filled with water.

On 23 July 1992 a metamorph L.aurea was provided from a vacant lot in an inner (metropolitan) Sydney suburb (the localities are kept imprecise to prevent potential disturbance of these populations). It was placed in a small aquarium and immediately started feeding on adult male and juvenile *Blattela germanica* cockroaches - adult females were too large for it at this stage. It was kept in a plastic aquarium 26cm x 15cm x 19cm high. This had a gravel substrate and some small river stones to provide an island with some bare rooted sprigs of *Chlorophytum.* The aquarium was then filled with water to a depth of approx. 35mm.

Both aquaria were heated by a desk lamp and the temperatures kept at approx. 24°C for twelve hours 'daylight' and approx. 21°C for a night cycle. The juvenile grew from approx. 30mm to 64mm in the 9 months 21 days to 12th May, 1993. At 40mm it took juvenile/subadult *Periplaneta spp.* cockroaches and then adults of *P.fuliginosa* and *P.australasiae* when it was 50mm. Throughout this period its main diet was cockroaches - other insects were offered if available but cockroaches were most frequently available. The cockroaches were trapped live in jar traps and these were baited with apple cores and dog food.

The cockroaches and their stomach contents when ingested were thought to contain all the trace elements required certainly no abnormalities or bone deformations were noticed. Water snails were eaten by both specimens. The empty shells were subsequently found but it was not observed if these were regurgitated or defecated. Small (3cm) yabbies *(Cherax destructor)* were apparently eaten by the female - no trace of shell was found. The female had grown from approx. 70mm to 84mm during its 14 months.

Throughout this time it remained bright green but the juvenile remained dark brown with a few dark green patches. Both had white throats and bellies and copper dorsolateral folds. Physically the juvenile resembled the adult. On 30th December, 1992 the adult female was moved into a larger container 78cm x 36cm x 35cm high for a temporary Museum public display of frog disappearances and possible ozone links. This container has a river sand substrate half submerged to a depth of 60mm - the other half rising up as a sandy bank. This was interspersed with *Cyperus* grass and river stones and illuminated with a 60cm grolux tube. The 12 hour day temp was 23°C - night temperature 21°C. In May, 1993 the container with its resident frog were being prepared for another temporary gallery. It was decided that the juvenile was too big to be swallowed so it was placed in with the female on 11th May after both had eaten as many *Periplaneta* as they could hold.

On being placed in the container, the female oriented towards the juvenile which ducked its head and raised its body up off the ground on stiff legs. The female appeared to ignore it from then on but the juvenile appeared excited and moved about the aquarium in short hops and much orienting as though sighting food although none was present.

The following day all was well and the juvenile seemed less agitated. There was a slight fall of rain that night. The following morning the frogs were observed in amplexus sitting half in the water. They remained in amplexus until midday on 14th May when they parted. No eggs were observed. Later that afternoon an adult *P.americana* cockroach was offered and it was chased and caught by the female. The male immediately hopped over and again amplexed the female while she swallowed. The female began making 'release' calls but the male remained attached. It was noted that the male's throat was beginning to darken with pigment. On Monday 17th the pair were again separate but the pigmentation on the throat of the male was more pronounced. As an experiment I began to imitate the call of *L.aurea* and after about a minute during which both frogs reoriented several times the male began to call back the full 3 "wahs" ... with the crok ... crok ... in between although sometimes this latter was omitted. This was repeated the following day. In both cases the male alternated my imitation i.e. not chorusing as has been reported. The male called on land both times. Unfortunately the female died on Sunday 13th June, 1993. An autopsy by Dr Glen Shea revealed that one lobe of the liver had a tumorous appearance.

In addition to these specimens five probable *L.aurea* tadpoles were received on 18th December, 1992. Although of various sizes all appeared to be from the same batch and metamorphosed at around the same time. The tadpole diet was crushed lettuce plus any algae growing on the aquarium sides. Three of the five tadpoles developed kinks in their tails to varying degrees prior to the development of their hind legs. It could not be determined whether the cause was bacterial, dietary, temperature, or hereditary but temperatures were kept at 23°C daytime and 21°C night in the same manner as the frogs were maintained. In any case at metamorphosis no obvious indication of deformity could be detected beyond a slight deflection in the urostyle stripe in one specimen.

Two metamorphs the largest and the smallest were kept for inclusion in the potential breeding program. Early observations indicate they are growing just as rapidly as the earlier specimen with s.v. lengths of 35mm and 45mm as of 27th May, 1993. It is hoped that a future breeding attempt with these individuals will prove successful.

THE TIGER SNAKE *NOTECHIS SCUTATUS* (SERPENTES: ELAPIDAE) IN TASMANIA

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INTRODUCTION

There is little published information on the habits and ecology of the tiger snakes occurring on the main island of Tasmania, and the majority of surrounding islands. Lord (1918) wrote a brief paper entitled 'Notes on the Snakes of Tasmania'; Dredge (1981) chose a central highlands population as a study base; Whitaker (1992) outlines temperature relations, Schwaner (1988) has an ongoing research project on Chappell Island in the Furneaux Group. Other brief references are scattered throughout the literature.
This work is presented as an overview, drawing together previous literature records and the author's own observations over a fifteen year period.

TAXONOMIC STATUS

The genus *Notechis* has been split into two separate species: *N.scutatus* and *N.ater*. Four subspecies of *N.ater* are currently recognised, with various authors (Worrell, 1970; Dredge, 1981; Gow 1982, 1989; Cogger, 1983; Mirtschin & Davis, 1987; Wilson & Knowles, 1988; Hoser, 1989; Ehmann, 1992) naming specimens from the main island of Tasmania, and all other western Bass Strait islands, as *N.a.humphreysi* (subspecies based on specimens from New Year Island); and also lumping all the tiger snake populations in the Furneaux Group as *N.a.serventyi* (based on specimens from Chappell Island) for no apparent reason other than island proximity. Both subspecies were erected by Worrell (1963).

These taxonomic divisions are unworkable in a practical sense, with overlap of characteristics between populations, and should be discarded (Table 1). A recent taxonomic revision of *Notechis* by Rawlinson (1991) does not recognise the various subspecies but still retains *scutatus* and *ater* with all the tiger snakes from the Tasmanian region described as *ater*. Shine (pers. comm.) has reservations about the current taxonomy and treats all *Notechis* as *scutatus* because he does not wish to reinforce the existing divisions; while Schwaner (1985b, pers. comm.) believes that *Notechis* consists of a single taxon showing extensive clinal variation. After personally examining over 1800 tiger snakes from all over Tasmania and eight offshore islands, the author has found no morphological characteristics to be constant for a single population and fully supports the view of Schwaner.

Table 1. Scale counts for currently accepted taxonomic divisions of *Notechis*

Species/ Sub species	Midbodies	Ventrals	Sub-caudals	Source
Notechis scutatus	17,19,21	140-190	35-65	Mirtschin & Davis (1987) Rawlinson (1965)
N.ater ater	17	163-173	41-50	Mirtschin & Davis (1987)
N.a. niger	17,18,19,21	160-184	45-54	Mirtschin & Davis (1987)
N.a. occidentalis	17,19	140-165	36-51	Storr (1982)
N.a. serventyi	17	160-171	47-52	Worrell (1963)
N.a. humphreysi	Tasmania: 13,14,15,17,18,19 New Year Is: 17 Christmas Is: 17	161-174	48-53	Lord (1918) Worrell (1963) Authors Observations

MORPHOLOGY

Many authors (Worrell, 1970; Mirtschin & Davis, 1982; Cogger, 1983; Rawlinson, 1974; Gow, 1989; Hoser, 1989; Ehmann, 1992) describe Tasmanian *N.scutatus* as being melanotic with some specimens having bands to a greater or lesser degree. The truth is that truly melanotic specimens are the exception rather than the rule. (Gow (1989), Hoser (1989), Storr, Smith & Johnson (1986), Weigel (1980) and Worrell (1970) record melanotic specimens occurring occasionally throughout mainland *N.scutatus* populations). While they may occur in all populations they are most prevalent in the cooler west, south west and highland areas of the state. For the majority of lowland populations in the eastern half of Tasmania, the dorsal colour phases are so diverse that it is not possible to adequately describe them. Specimens can range from black with or without yellow, orange, brown or cream bands, grey, chocolate brown, khaki, tan with or without darker or light bands, greenish, yellow, oatmeal or whitish with or without bands (Figures 2-7). A similar range of dorsal colours can be observed among the Bass Strait islands.

Ventral colour can range from all white, cream, yellow or orange, more usually fading to greyish towards the vent to all greyish or completely melanotic. The author has received reliable but unconfirmed reports of red bellied tiger snakes from Tasmania's north east. It was assumed that copperheads, *Austrelaps superbus* may have been responsible for these reports but Schwaner (1984, 1985a) confirms the existence of red bellied tiger snakes on Kangaroo Island, South Australia.

The more melanotic populations appear to be the result of adaptation to the much cooler conditions prevailing in those regions. In Tasmania's generally cool climate, it would be expected that all tiger snakes would be dark, but clearly the range of colour phases displayed aid in avoidance of detection by visual predators, but in particularly cool parts of the state the relative importance of efficient basking may outweigh other selective pressures. Melanistic traits among the Bass Strait Islands, particularly those islands with one seasonal saturating food source, are probably best explained by the importance of efficient basking and digestion in the crucial feeding period, particularly if conditions become cool and/or overcast. Predation pressure on subadults and adults from visual predators is also reduced or absent on many small muttonbird islands.

Perhaps the most unusual local adaptations occur in Tasmania's central plateau where melanotic specimens are common but in addition enlargement of the dorsal scales, particularly on the forebody, give rise to unusually low mid body scale counts, often 15 and as low as 13, giving some maximal size specimens a most unusual appearance with scales as large as a man's fingernails. Such large scales may enable more efficient basking in the short and unpredictable highland summers. Ehmann (1992) erroneously describes these populations as 'smaller, sparse, all black form'. In fact, they are common to abundant, display similar colour ranges as lowland forms, although lighter coloured specimens are less frequently encountered. Further they grow to the same maximum size as lowlands populations (1.8m) and hand reared neonates grow at the same rate as lowland forms. Mid body scale counts generally for Tasmania can be anywhere from 13-19 with 17 being the norm. Worrell (1970) describes counts of between 15 and 19 on the same snake for Tasmanian specimens.

Other characteristics such as head size and shape show continuous minor variations within and between populations, throughout the range of *N.scutatus* and in some cases appear to reflect adaptations to differences in types of prey consumed.

DISTRIBUTION AND HABITAT

The distribution of *N.scutatus* in Tasmania has been accurately defined by Dredge (1981) who states this species 'is distributed throughout a considerable variety of habitat types from coastal heath at sea level, to highland forests above 1000m. Some habitats not inhabited by tiger snakes in Tasmania are characterised by closed canopies with wet and/or dark substrates (temperate rainforests) or alpine moorlands occurring at high altitudes, possessing sparse, low lying vegetation and occurring above the winter snowline'.

N.scutatus also occurs on a large number of Tasmania's offshore islands where a similar range of habitat types are occupied. Green & Rainbird (1993) list islands with *N.scutatus* populations present apart from the following omissions: Badger Island (Worrell, 1963), Bruny Island (pers. obs.), East Sister Island (pers. obs.), Preservation Island (reliable reports to author), Swan Island (remains in raptor pellet examined by author), Vansittart Island (Mirtschin & Davis, 1982). Undoubtedly other populations await formal recognition.

Tiger snakes have taken advantage of land clearing in Tasmania and are very common in semi-rural habitats where there is a mixture of forest and/or remnant scrub and regrowth areas mixed with pasture and cropping or where cleared land adjoins expanses of forest.

In many cleared, pastoral areas tiger snake populations are concentrated along creek and river courses where in many cases a small strip of natural vegetation was left along the stream banks when the land was originally cleared. In addition, rocks and logs cleared from paddocks are often dumped along river and creek margins and these provide excellent homesites.

Tiger snakes occur in forested areas all over Tasmania, and in particularly dense, closed wet sclerophyll and/or mixed forests the snakes are forced to become partially arboreal, living in cracks on the upper surface of large logs which are often the only relatively dry homesites with basking opportunities. Basking and foraging will also take place in trees and shrubs as much as 5m off the ground. Rawlinson (1974) also records this behaviour. Schwaner (1991) outlines spatial patterns of *N.scutatus* on southern Australian offshore islands.

HOMESITES AND ACTIVITY RANGES

The author has recorded *N.scutatus* living under logs, in the decayed root systems of stumps, in piles of rocks, beneath individual boulders, in rabbit burrows, beneath piles of lumber and wood heaps, foundations of disused houses, piles of bark in logging coups, sawdust heaps and windrows. Dredge (1981) gives detailed descriptions of homesites and associated basking pads.

Overwintering Tasmanian *N.scutatus* are rarely found with the author having only five records. Two snakes were discovered overwintering in a disused rodent burrow in a large pile of earth. The snakes were together in a small chamber at the end of the burrow 1.2m below the surface. Two adults were discovered at the base of a large pile of boulders in a paddock during clearing operations and Goss (pers. comm.) reports an adult falling out of a chamber in the side of a road cutting during road building operations. This specimen was approximately 1.2m below ground level. The author has recorded neonate Tasmanian *N.scutatus* overwintering deep inside large standing, dead eucalypts having gained access via large cracks in the outer surface of the trunk. Neonates born late in the season (April) often have little opportunity for dispersal before being forced into torpor by cold, wet conditions so the author has recorded as many as 26 neonates overwintering together in the same hibernacula. Shine (1979) discovered that adult *N.scutatus* in the Armidale region of NSW overwintered singly in shallow hibernacula.

In the author's experience, Tasmanian *N.scutatus* do not utilise one homesite for an extended period, but move considerable distances during a season, and utilise several homesites in an area. The amount of time spent at a homesite varies from snake to snake but it is generally less than 15 days with the longest recorded residences being for gravid females. The longest residency at one homesite was 50 days for a female.

Male snakes in particular, appear to be habitual vagrants and are continuously on the move, especially in the reproductive season, no doubt in search of receptive females. Between 1986 and 1993 the author recorded notes for 132 tiger snakes in and around the Liffey Valley in northern Tasmania. Of these, 56 were initially observed well away from any suitable homesite, or if a potential homesite was present nearby, the snake was seen in the area only once. Of the remaining 76 the majority used a particular homesite for between 2 and 5 days before

vanishing. Of this group of snakes 67% were male. Tasmanian *N.scutatus* it would seem, wander widely and continuously in large areas of relatively homogenous habitat. Dredge (1981) found the same to be true for highland populations and Shine (1979) also found large activity ranges for *N.scutatus* in the Armidale district of NSW. Dredge (1981) gives detailed accounts of daily activity patterns.

Shine (1987b) records large activity ranges for black snakes, *Pseudechis porphyriacus*, but more importantly discovered that it was difficult to ascertain 'typical' behaviour with unexpectedly high variability in habitat use, activity levels, daily movements and activity ranges. In addition, significant variation was discovered between individual snakes, between sexes, among seasons, among years, and among study areas. *N.scutatus* like *P.porphyriacus* is a large active elapid occurring over a wide geographic area and occupying a wide range of habitat types. A long term, detailed radiotelemetric study involving geographically separated populations will probably reveal similar variations.

SIZE RANGE

Various authors (Worrell, 1970; Mirtschin & Davis, 1982; Wilson & Knowles, 1988; Ehmann, 1992; Cogger, 1983) have recorded maximum lengths for Tasmanian *N.scutatus* ranging from 1.4-1.6m. However maximum length is in excess of 1.8m (total body length). The longest wild caught specimen examined by the author was a male 1.8m long (SVL 1555mm) with a weight of 2 kilos. The heaviest, also a male, 1.78m long and 2.2 kilos. Goss (pers. comm.) examined a 1.86m male and Lord (1918) records a 1.88m specimen. Similar maximum lengths are typical for offshore islands with the exception of Chappell Island where males can exceed 2m (Worrell, 1963; Schwaner, pers. comm.). Tasmanian females do not grow as large as males with the largest non gravid female examined by the author being 1.5m long (total length) and weighing 1.4 kilos.

Average length of *N.scutatus* encountered in Tasmania is difficult to quantify as it varies with locality, but typically specimens range from 1.1 to 1.5m in total length. Specimens from rural and semi-rural habitats are consistently longer and heavier than those from undisturbed habitats which seems to reflect different prey types and abundance. Dredge (1981) also observed considerable differences in body length and weight between two populations only 10 km apart and this he attributed to variation in prey abundance.

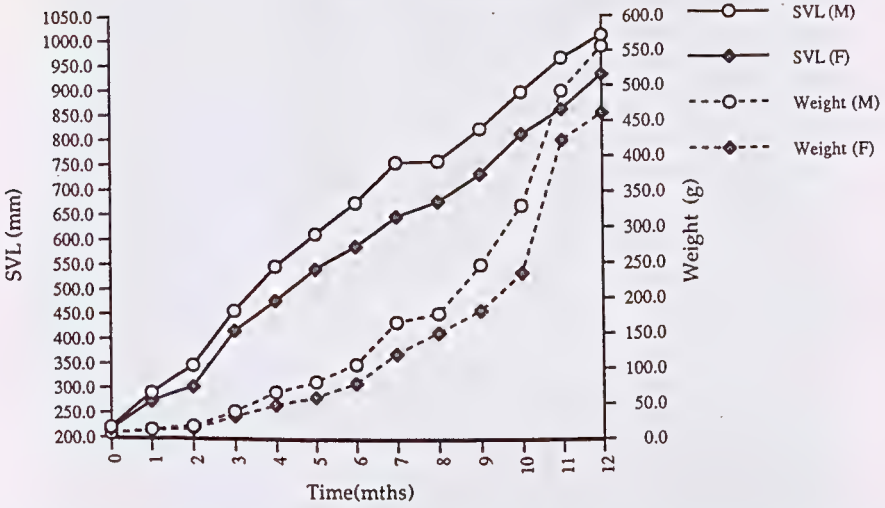
Schwaner (1985b, 1988, 1990) has suggested that ecological differences between different populations (particularly islands) such as average and maximal body sizes, degree of sexual dimorphism in body size, adult sex ratios and frequency distributions of individuals in different size classes are due to adaptations to different prey types, seasonality of prey and prey abundance.

GROWTH AND MATURATION

Shine (1978) states that both sexes of *N.scutatus* in the Armidale area of NSW attain sexual maturity at an SVL of 650mm at 2 years of age and that they more than doubled their length in the first year. Barnett & Schwaner (1984) studied growth rates for neonate Chappell Island *N.scutatus* under laboratory conditions and found that both sexes attain sexual maturity at just over a metre in body length.

Tasmanian neonates raised by the author (3 females, 3 males) under similar conditions to those of Barnett & Schwaner (1984) increased form 4-5 grams at birth to 460-600g at 12 months of age with body lengths increasing from 215-220mm to between 900 and 1000mm (Fig. 1). In the eleventh month a male 950mm long and 490g in weight exhibited courtship and sexual behaviour with a female 900mm in length and 500g in weight. Increases in length were highest in the first 6 months with weight increasing faster in the latter 6 months. At the onset of sexual maturity both sexes were similar in length and weight. Munday (pers. comm.) reports similar growth rates for Tasmanian neonates and also observed copulation when both sexes were 500g in weight.

Figure 1: Growth of male and female Tasmanian *N.scutatus* observed in courtship and sexual behaviour at 11 months of age.



As the only indication that sexual maturity has been attained is male courtship behaviour, the females may have been sexually mature at a smaller size but were not attractive to the as yet non sexually mature males. Further indication of this is the rapid increase in weight between the tenth and eleventh month (Fig. 1) which probably coincides with the onset of sexual maturity with the male maturing later than the female.

The two smallest gravid wild caught females examined by the author were 850mm SVL, 325g weight, and 852mm, 380g in weight. The former contained 12 ova and the latter contained 10.

Tasmanian *N.scutatus* are on average larger snakes than mainland specimens (based on observations by Shine (1978), Schwaner & Sarre (1990)) and appear to reach sexual maturity at a larger body size, but probably do so in 2-3 years, a similar time period as NSW *N.scutatus*.

Schwaner (1985b; 1988) outlines adaptive responses to different prey types (especially prey size) that result in the variation observed between island populations in respect to body size when sexual maturity is attained.

REPRODUCTION

Sexual activity in Tasmanian *N.scutatus* occurs sporadically throughout the summer but reaches a peak in late January and February. Males are attracted to females by a powerful pheremone (Shine, 1991). The author has recorded a good example of this when a dead female was found entangled in plastic netting around a garden. Two males were entangled with the female (one dead) and two more were moving along the base of the netting.

The author has found courtship and sexual behaviour to be identical to that described by Bush (1983) for Western Australian *N.scutatus* and also observed that actual copulation always took place under cover in a large outdoor enclosure. Copulation continued for extended periods up to seven hours. During that time females would occasionally move from one piece of cover to another and simply drag the male along behind them. The male would not impede the female's progress but would go limp to enable her to pull him through obstacles.

Figure 2. A typical specimen of the lemon yellow morph. of the Tasmanian tiger snake, showing the silver/ grey head. Yellow specimens without bands are not uncommon in parts of Tasmania.(photo:Bruce Munday)

Figure 3. Bass Strait Island tiger snakes are usually referred to as black, however every island I have visited displays some startling morphs. This Christmas Island snake looks remarkably like an eastern tiger snake and has the colour on the throat extending all the way along the lower jaw. (photo: Bruce Munday)

Figure 4. Melanotic tiger snakes in the strict definition of the term display no bands or markings at all. True melanotic specimens are therefore scarce. This specimen is as black as they get and the outsize highland scales are evident on the fore body. (photo: Bruce Munday)

Figure 5. Another morph. found in the eastern half of Tasmania. (photo: Bruce Munday)

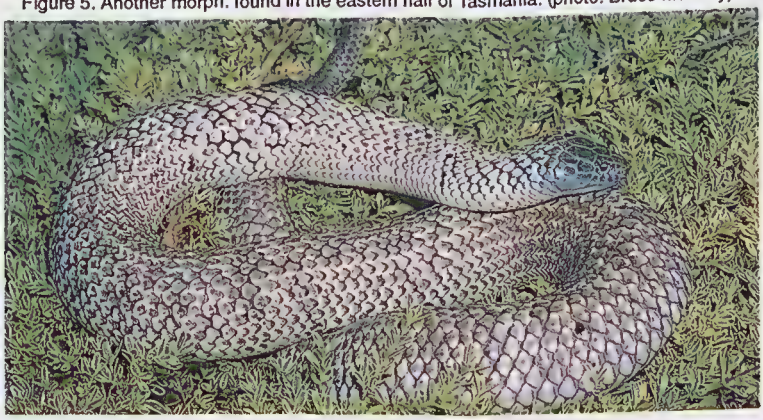


Figure 6. A narrow banded form from Tasmania with the colour extending up under the mouth. (photo: Bruce Munday)

Figure 7. A honey coloured morph. which is reasonably common in some parts of Tasmania. (photo: Ross Bennett)

Sexually active males in the wild will share homesites with females. One female under observation was living in a cavity under a boulder and was later accompanied by a male for 3 days. The male was engaged in courtship activity whenever both snakes were seen outside the homesite together. Two weeks later the same female was accompanied by two males for two days. Copulation was not observed before the males moved on, however the evidence from captive studies suggests that it may well have taken place under the boulder.

During sexual activity males refuse food for several weeks. Road killed males at this time also rarely contain prey. Bush (1983) also records this behaviour. Capture and digestion of prey (particularly large endotherms) may impede movement and also requires extended periods of basking, limiting valuable time in location of receptive females. Females cease to feed 3-4 weeks prior to parturition. Shine (1979) also found reduced food intake for gravid females.

There is little obvious sexual dimorphism displayed by Tasmanian *N.scutatus* until body lengths approaching maximal size are attained with males growing to greater lengths and weights than females and also having longer, broader heads. Schwaner and Sarre (1990) also found little sexual dimorphism in Tasmanian *N.scutatus*. Shine (1987a) and Schwaner (1985b; 1988, 1990) outline degrees of sexual dimorphism in other populations of *N.scutatus*.

Shine (1977, 1978ab) concludes that larger male size relative to female size is an adaptation to intrasexual competition between males and records male-male combat in mainland *N.scutatus*. The author has never observed male-male combat in Tasmanian *N.scutatus* either in the wild or captivity, even though sexual activity occurred every season in a large outdoor enclosure. On several occasions up to three males were attempting to copulate with a single female with no indication of aggression whatsoever. The most persistent male successfully copulated. The author has also maintained Christmas Island *N.scutatus* in an outdoor enclosure and again no male-male combat was observed even though multiple males were observed attempting to copulate with one female. Schwaner (1985b; 1988) observed no evidence of male-male combat on numerous offshore islands supporting populations of *N.scutatus*, however Norton (pers. comm.) observed three males on Chappell Island engaged in combat. The smallest specimen eventually left the scene and the two largest disappeared into thick vegetation. No female was observed in the immediate vicinity. Considering the intense study this population has been under since 1985 it is clear that male-male combat is not a common event as it has never been observed previously. Clearly more detailed research is required to discover the factors that initiate this behaviour in *N.scutatus*.

Tasmanian *N.scutatus* mate in late summer followed by ovulation in spring and parturition in late summer of the following season (Shine 1977a, 1977b; Bush 1983; Schwaner 1985b, 1988). The author has found clutch sizes to be typically 10-30 with maximal sized females (total lengths between 1370 and 1500mm) giving birth to very large litters. The three largest clutches the author has examined consisted of 45, 51 and 64 individuals. Shine (1977b, 1987a) and Schwaner (1988) also found fecundity was correlated with maternal body size.

Lord (1918) gives a clutch record for Tasmanian *N.scutatus* of 109 and this figure has been repeated by numerous authors. However, the author believes this figure should be treated with caution. Andrews (pers. comm.), curator of Vertebrate Zoology at the Tasmanian Museum, could find no record of such a litter ever having been at the museum, however a clutch of 24 neonates is present that reputedly originated from a 109 inch female (an equally unlikely figure) at the time Lord was there. The author believes this to be a significant coincidence and with Andrews (pers. comm.) suggests the Lord reference be disregarded.

Schwaner (1985b; 1988) outlines the ecological differences between island populations that result in the variation of clutch size and neonatal length and weight observed. Typically island *N.scutatus* produce fewer, larger young. Cashion (1959) recorded three clutch sizes of 12-13 with neonate lengths between 150 and 190mm in length on Cat Island. Schwaner (1988; pers.

comm.) records litters of 10-31 with neonate lengths between 270 and 300mm and weights from 7-12g for Chappell Island neonates. The author recorded a litter of 8 neonates between 205-251mm and weights from 3.4-7.5g for a Christmas Island female (SVL 1085mm, weight 700g). Neonate Tasmanian *N.scutatus* typically range from 215-270mm in total length and from 4-5g in weight. Shine (1987; 1977b) provides data on clutch sizes and neonatal lengths for various mainland populations.

Female *N.scutatus* in the Tasmanian region reproduce, at best, every second year. Even captive females of Tasmanian, Chappell Island and Christmas Island populations show biennial reproduction in spite of access to large amounts of food. Biennial reproduction is also reported by Schwaner (1988) and Shine (1987a).

PREY

Tasmanian *N.scutatus* are foraging, opportunistic feeders, unselective in respect to prey type or size. Dredge (1981) gives detailed accounts of foraging behaviour and capture of prey. The author has recorded prey species consumed by *N.scutatus* since 1983 from road and human killed specimens and by palpation of living snakes. The records have been gathered from all over Tasmania with most records from semi-rural and disturbed forest habitats, and are presented in Table 2.

Dredge (1981) found that Tasmanian highland *N.scutatus* living around the perimeters of shallow, marshy highland lakes and lagoons were feeding predominantly on frogs, mainly *Litoria ewingi* and *L.raniformis*. Shine (1987a) concluded from this that frogs comprised the major prey of Tasmanian *N.scutatus*. However, over most of Tasmania frogs are not present in large enough numbers to play a major role in the diet of adult snakes. The author has only recorded identifiable frog remains on ten occasions over a ten year period. *N.scutatus* populations around large fresh water bodies such as those studied by Dredge (1981) undoubtedly feed predominantly on frogs as they are present in such large numbers that they will be frequently encountered during foraging, furthermore energy expenditure in foraging time is minimal when frogs are available in such abundance. It is significant that since the study by Dredge (1981) in the Lake Sorrell/Crescent area, both the numbers and average size of *N.scutatus* encountered in that area are now greatly reduced. The numbers of frogs have declined markedly due to human interference to lake levels, and a succession of dry years through the 1980's. *Litoria raniformis* appears to have vanished from the area completely and other species are present in reduced numbers (pers. obs.; Mawbey, pers. comm.). Shine (1987b) records substantial population declines in another large, anuran eating Australian elapid, *Pseudechis porphyriacus* living around marshes after a prolonged drought.

Mainland *N.scutatus* populations appear to be commonly concentrated around water bodies (Worrell, 1957, 1966, 1970, 1972; Mitchell, 1961; Rawlinson, 1965; Mirtschin & Davis, 1982; Storr, Smith & Johnson, 1986; Gow, 1989; Hoser, 1989, 1991; Weigel, 1990; Ehmann, 1992) where frogs would be the most commonly encountered prey species for foraging *N.scutatus* (Shine, 1977; 1987a).

From the author's experience endotherms up to 300g in weight are the principle prey of Tasmanian *N.scutatus*. Adult *N.scutatus* from rural and semi-rural habitats appear to feed predominantly on introduced rodents (black rat *Rattus rattus*, house mouse *Mus musculus*) and juvenile rabbits *Oryctolagus cuniculus*, which may account for the larger average body size and weights encountered in these habitats. In forest habitats passerine birds (nestlings, fledglings) begin to make up a considerable portion of the diet as well as introduced and native rodents. Tasmanian *N.scutatus* habitually raid bird nests (Fearn, 1988; Green, 1982 and pers. comm.) and will climb into trees, shrubs, outbuildings and into the roofs of houses in search of them. Forestry workers frequently encounter nest raiding *N.scutatus* while carrying out pruning operations in pine plantations (Smith, 1991). Webb (1981) describes tree climbing and nest raiding behaviour for mainland *N.scutatus*. Ellis (pers. comm.) reports Christmas Island *N.scutatus* consuming Silver Gull chicks *Larus novaehollondiae*.

The diets of island *N.scutatus* vary from only one major seasonal food source such as hatchling short tailed shearwaters, *Puffinus tenuirostris* (Schwaner & Sarre, 1988) on small islands to larger islands with a variety of habitat types and a wide variety of potential prey species.

Table 2: Prey Records for Tasmanian *N.scutatus*

PREY	NO. OF RECORDS	AGE/SIZE OF PREY
MAMMALS		
black rat *Rattus rattus*	18	juveniles, subadults, adults up to 300g
swamp rat *Rattus lutreolus*	6	subadults
house mouse *Mus musculus*	27	juveniles, subadults, adults
new holland mouse *Pseudomys novaehollandiae*	1	adults
brown bandicoot *Isoodon obesulus*	2	juveniles 50-60g
eastern barred bandicoot *Perameles gunnii*	1	juvenile 60g
rabbit *Oryctolagus cuniculus*	7	juveniles, subadult
unidentified mammals	3	
	total: 65	
BIRDS		
domestic duck	1	hatchlings
brown thornbill *Acanthiza pusilla*	2	fledglings
spotted pardalote *Pardalotus punctatus*	1	nestlings
house sparrow *Passer domesticus*	2	fledglings
common starling *Sturnus vulgaris*	1	fledglings
superbblue wren *Malurus cyaneus*	6	fledglings
black bird *Turdus merula*	1	fledgling 53g
Tasmanian native hen *Gallinula mortierii*	2	nestlings
passerine eggs	1	
unidentified Passerine remains	9	
	total: 26	
REPTILES		
skinks *Niveoscincus sp.*	5	adults
Bluetongue *Tiliqua nigrolutea*	1	adults 200mm
	total: 6	
AMPHIBIANS		
brown tree frog *Litoria ewingi*	8	adults
brown froglet *Crinea signifera*	2	adults
	total: 10	

In the author's experience reptiles are rarely preyed upon by adult *N.scutatus* in Tasmania. All of the snakes that contained skinks *Niveoscincus* sp. (Table 2) were juvenile, with one exception. The author recorded a 200mm blue tongue, *Tiliqua nigrolutea* consumed by a 1.2m snake and Cashion (1959) also records *T.nigrolutea* as prey on Cat Island. Worrell (1970)

reports New Year Island *N.scutatus* to be ophiophagus. The author has observed no evidence of this behaviour in either Tasmanian or Christmas Island *N.scutatus* of which the latter is often lumped together with New Year Island populations, in respect to this behaviour. Schwaner (pers. comm.) has found ophiophagy to be rare on Chappell Island and Shine (1987a) only recorded one instance for NSW populations.

Carrion may be consumed more often than has been recorded as newly captured Tasmanian *N.scutatus* will take dead rodents or day old chickens without hesitation. One wild caught specimen contained several sparrow fledglings *Passer domesticus*, one of which was fly blown. The two most unusual examples recorded by the author are both for Christmas Island *N.scutatus*. One large specimen disgorged two complete wings of an adult Shearwater, *Puffinus tenuirostris* during capture. Feral cats are present on the island and routinely sever the wings of birds they capture. The second and most unsavoury occurrence took place in captivity when a specimen consumed the putrid remains of a day old chicken disgorged by another snake.

Fish are captured and consumed by Tasmanian *N.scutatus*. Mirtschin (pers. comm.) captured a 1.2m specimen near Lilydale which disgorged a 200mm trout *Salmo sp.* Brereton & Peacock (1992) recorded the capture of a trout in the central highlands. Morris (pers. comm.) reports a trout being attacked near the shore at Lake Silver when reeled in by an angler, the fish having to be cut free when the snake refused to relinquish its hold. He also records a native Galaxia being taken at Lake Ada and states 'A metre long tiger snake was draped around a rock in the shallows. The head and upper body of the snake lay immersed under about 6 inches of water and it has fastened onto a 5 inch native galaxia gripped crosswise in its jaws'.

PREY CONSTRICTION

Tasmanian, Chappell and Christmas Island neonate *N.scutatus* often constrict skinks when they are initially grasped. This behaviour appears to be innate as neonates will behave identically with dead skinks. Shine & Schwaner (1985) postulate that *N.scutatus* venom appears to be relatively slow acting on ectothermic prey, increasing the risk of escape or injury to the snake. Adult Tasmanian *N.scutatus* also occasionally constrict large endotherms such as mice and rats, particularly when such prey is grasped around the hind quarters allowing the rodent to bite the snake around the head and neck. Shine & Schwaner (1985) also record this behaviour for Tasmanian *N.scutatus*. Wild caught Tasmanian *N.scutatus*, particularly in rural habitats, often have rodent bite scars on their bodies which indicates snakes often encounter difficulties when attempting to capture such prey and the presence of scars over the entire body as far as the vent area indicate that constriction may be more common than is realised, as it is difficult to explain scars so far from the snake's head/neck area in any other way.

ACKNOWLEDGEMENTS

Sincere thanks to Terry Schwaner, Bruce Munday, Ian Norton, Bob Green, Chris Spencer, Phillip Goss, Phillip and Suzie Ellis, Scott Mason and Maria Hennessy. Special thanks to Sally Staubmann for keeping detailed notes on activities of snakes living in her garden, and Kay Dimmack of the Queen Victoria Museum for promptly and cheerfully obtaining numerous references. My undying gratitude to the Rat Men, David Jacobs, Murray Plaister and Alan Norris at the University of Tasmania, without whom growth rate data would not have been obtained. Thanks to all the other people, particularly landowners, who provided specimens, observations and access to land over the years.

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ABOVE GROUND MOVEMENTS AND NEW INFORMATION ON HABITAT OF *APRASIA PARAPULCHELLA* REVEALED BY PITFALL TRAPPING

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During November and December 1992, and March 1993, pitfall trapping was conducted in the Stony Creek Nature Reserve, along the Murrumbidgee River in the Australian Capital Territory, as part of a general fauna survey (Rauhala in press). The survey provided valuable information on the vertebrate fauna of the Murrumbidgee River Corridor in this region, including information on 24 species of reptile, 19 of which were captured in pitfall traps.

Among the pitfall captures were eleven individuals of the nationally endangered pink-tailed legless lizard *(Aprasia parapulchella)*. Virtually all previous records of this lizard have been the result of searching beneath stones, where the animals are found in burrows near the soil surface during suitable weather (Osborne *et al.* 1991).

Specimens of *A. parapulchella* were caught at three of the six pitfall trap sites (Table 1). However, their presence at two of these sites had already been established through searching under rocks near the trap sites. The habitat type at the sites was typical of other known locations supporting the species in the ACT in that there was an extensive cover of partially buried rock and a cover of predominantly native grasses, including *Themeda triandra* (kangaroo grass). *Themeda* is thought to strongly correlate with the presence of the lizards (Osborne *et al.* 1991; 1993, Jones 1992).

An unexpected finding was the capture of *A. parapulchella* in pitfall traps established in teatree *(Kunzea ericoides* and *Leptospermum brevipes)* scrub. This site had very little seemingly suitable rock although the soil was quite gravelly, consisting of decomposing rhyodacite. The site had virtually no grass, was characterised by large areas of bare ground and an extensive cover of open woody scrub (Rauhala in press). At a distance of about 100 metres up slope there was a small area of exposed rock, with a sparse cover of grasses including *Aristida* sp., *Danthonia* sp. and *Panicum* sp. This area, although considered only marginal for *A. parapulchella* habitat may be the source for the lizards caught in pitfall traps in the nearby teatree scrub. However, it is more likely that factors other than grass and rock cover may determine the presence of the species at this site, and indicates that some reassessment of the habitat requirements of the species is warranted.

Pitfall trapping of *A. parapulchella* has provided important evidence of the above ground movement of this species which has only been witnessed on two occasions (W. Osborne and R. Bennett *pers. comm.*). It has confirmed the potential of trapping as an effective additional method of sampling populations, and may provide new information on the habitat occupied by this poorly known species.

Table 1. Number of *A. parapulchella* caught by pitfall trapping in Stony Creek Nature Reserve

SITE	VEGETATION	NO. OF TRAP NIGHTS	NO. OF INDIVIDUALS CAPTURED
1	*Eucalyptus rossii open forest*	1480	-
2	*Kunzea ericoides* scrub	1406	4
3	*Eucalyptus macrorhyncha* open forest	1406	-
4	*Eucalyptus macrorhyncha* open forest	1480	-
5	*Eucalyptus blakelyi* grassy woodland	1480	5
6	*Eucalyptus blakelyi* grassy woodland	1480	2

ACKNOWLEDGMENTS

I wish to thank Will Osborne for his assistance and advice. The staff of the Murrumbidgee River Corridor and the Australian Trust for Conservation Volunteers contributed to these findings through their extensive involvement with field work.

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A NOTE ON GROWTH RATES AND DIET OF HATCHLING *MOLOCH HORRIDUS*

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INTRODUCTION

The Australian agamid *Moloch horridus,* has proved a difficult species to maintain in captivity, due mainly to a diet believed to consist solely of ants (Pianka, 1986; Wilson and Knowles, 1988; Ehmann, 1992).

Attempts to keep this species in captivity for any length of time have ranged from 22 months (Boylan, 1970) to 3 years (Banks, *pers. comm.*) for zoos and 13 years for a private collection (Sporn, 1965).

On the 5th of December, 1992, a gravid female was donated to the Western Plains Zoo, Dubbo, NSW after it had been inadvertently transported interstate from Western Australia in earth moving equipment. Attempts to ascertain the provenance of the female for release were unsuccessful.

INCUBATION AND HATCHING

Nine eggs were oviposited in a small carrying container on the 6th December and on the 22nd December both these and the female were transported to Taronga Zoo. Seven of the eggs were discoloured on arrival and spoiled within a few days, due we believe, to being wrapped in damp paper immediately after they were oviposited. The remaining two eggs, both of which measured 21mm in length and 16mm and 15mm in width on arrival, were placed in a $15cm^2$ plastic container three quarters filled with vermiculite and water (50:50 W/W) and completely covered.

The first hatching (hatchling No. 1) occurred on the 5th March and the remaining egg hatched the following day (hatchling No. 2). Incubation temperature varied from 25.7°C to 29.9°C and averaged 26.8°C during the 91 day period.

FEEDING

The adult female was placed on ant trails of Iridomyrex species on a daily basis for one hour periods. This ant species was known to have been consumed by a Moloch previously held at the zoo (Boylan, 1970) and is a genus of ant normally consumed by Moloch in the wild (Pianka, 1986; Wilson and Knowles, 1988). However, in this instance no ants were consumed during these hourly periods.

The adult female died on December 26, 1992 and autopsy revealed the cause of death as due to inanition. The time elapsed without feeding between its arrival at the Western Plains Zoo and its death was 22 days. Both hatchlings were placed in a $60cm^2$ glass fronted terrarium with sub floor heating augmented by an overhead 100 watt flood light. Average cage soil temperature directly beneath the flood light during the day was 38°C dropping to night-time low of 21°C. A shallow water dish was provided and a corner of the cage was lightly sprayed periodically. Drinking was not observed.

Petri dishes containing day old crickets *(Teogryllus commodus)* were offered daily. Additionally both hatchlings were placed on the ant trails already mentioned for up to three quarters of an hour daily. The first observed feeding occurred on the 10th March, 1993 when a few day old crickets were consumed by hatchling No.1, i.e. at 5 days old. The first ants were consumed on the 18th March (day 13) when hatchling No. 1 ate 46 and hatchling No. 2, 6 during a one hour interval. Thereafter one day old crickets were offered at three day intervals in addition to the lizards being placed on the ant trails daily, weather permitting.

The total number of ants consumed in a one hour period peaked at 127 in week 7 for No. 1 (ground temperature ranged from 24°C to 30°C during this hour) and 75 for No. 2 in week 5 (ground temperature ranged from 24°C to 33°C during this hour - No. 1 consumed 42 during the same period). The correlation between outside feeding response and ground temperature was complicated by the short time staff were available to allow the hatchlings on ant trails. Supervision, limited to hourly periods, was necessary to avoid possible theft and bird predation, and as the weather cooled some difficulty was encountered in finding suitable ant trails.

Crickets were offered in their cage and were only consumed if they were moving. Both Molochs would chase and eat the crickets as they dispersed up the cage walls but would lose interest if movement ceased. The maximum number of day old crickets consumed by either Moloch during a one hour observation period was 33 by No. 1 in week 9.

The animals died on 4.6.93 and 19.6.93. At this time No. 2 had refused food for some weeks and No. 1 had reduced its consumption significantly. The autopsy for No. 2 was unremarkable though the autopsy for No. 1 showed osteomyelitis.

Table 1. Numbers of ants and crickets consumed per week by two hatchling *Moloch horridus* from hatching until their death

WEEK	No. 1		No. 2	
	ants	crickets	ants	crickets
1	-	3	-	-
2	46	6	6	4
3	17	19	1	9
4	488	27	313	19
5	161	82	166	62
6	450	18	10	-
7	252	36	6	-
8	323	12	-	-
9	324	48	-	-
10	38	72	-	-
11	236	53	-	-
12	52	12	-	-
13	2	11	-	-

DISCUSSION

Day old crickets elicited a feeding response in the zoo's hatchling *Moloch horridus*, presumably due to their superficial resemblance to Iridomyrmex species of ants. Whether this dual diet of ants and crickets contributed to the deaths of both or either Moloch through metabolic dysfunction is uncertain. Autopsy results were inconclusive as there were no significant findings for No. 2 and autopsy for No. 1 showed death due to oesteomyelitis, an inflammation of the bone marrow caused by bacterial infection.

Taronga's incubation time of 90 to 91 days compares with a previous captive incubation time of 84-86 days at 28°C (Dunn, 1978) and in situ incubation times of 112 and 120 days (Hardy, 1991) and 90 and 128 days (Sporn, 1955), temperatures not recorded.

Further trials with adult Moloch to ascertain the suitability of small crickets as an alternative food source could prove interesting and if consumed with no deleterious effects, perhaps allow for increased longevity of captive animals.

Table 2. Weights (in grams) and body measurements (in mm) of two hatchling *Moloch horridus*, using an electronic balance and vernier callipers

DATE	No. 1			No.2		
	WEIGHT	S/V LENGTH	VENT/TAIL	WEIGHT	S/V LENGTH	VENT/TAIL
06.3.93	2.2	32	26	1.8	32	26
13.3.93	-	32	26	-	32	26
18.3.93	2.3	33	26	1.5	33	26
26.3.93	2.4	34	27	1.4	34	27
03.4.93	2.4	35	27	1.7	35	27
09.4.93	2.4	35	27	1.7	35	27
17.4.93	2.5	35	28			
22.4.93	2.6	35	28			
29.4.93	2.6	35	29			
13.5.93	2.8	35	30			
27.5.93	2.5	35	30			
01.6.93	2.5	35	30			

ACKNOWLEDGMENTS

Thanks to "Zoo Friends" personnel for recording observations whilst the Molochs were outside.

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A SIGNIFICANT RANGE EXTENSION OF *EGERNIA MARGARETAE PERSONATA?*

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In order to follow up a sighting, by fellow members of the South Australian Herpetology Group, of a rock-dwelling, spotted, "*whitii*-like" *Egernia* species I spent the 28th of August 1993 at Mootwingee National Park situated some 130km NE of Broken Hill, NSW.

The weather was conducive to reptile activity and soon after commencing a walk up the Homestead Gorge track in the early afternoon an *Egernia* (est. SVL 70mm) was located in plant debris beside the path. While a companion photographed the largely obscured and very wary lizard I observed it as closely as possible and tentatively identified it as *E.margaretae personata*. Another larger specimen was disturbed a little later but it was only glimpsed as it retreated to cover.

The resultant photographs show only the anterior third of the skink but are sufficiently clear to verify its identification, as *E.m.personata*, with reasonable certainty (M. Hutchinson, pers. comm.). The characteristic dark mask is evident as is some of the moderately dense pattern of faint grey-white spotting along the sides. This is a feature of *E.m.personata* not generally mentioned in published descriptions. The prominent cream spots and dorsal striation of the next most likely candidate, *E.modesta*, are absent and the head and body are not as deep as in this species.

Egernia margaretae personata has been considered to be a South Australian endemic, restricted to the Flinders Ranges (Knowles and Wilson, 1988, Cogger, 1992). Within SA, however, it has been found in some of the ranges of the Olary Spur (B. Miller, *pers. comm.*) to the east of the generally recognised distribution. The Olary Spur extends from the Flinders Ranges eastward to the Broken Hill region.

It is worth noting that another essentially South Australian lizard, *Ctenophorus decresii*, is common at Mootwingee and it may be that other eastern South Australian "endemics" exist in the region. Members of the South Australian Herpetology Group hope to be granted permission to survey the herpetofauna of Mootwingee National Park to investigate this possibility and confirm the presence of *Egernia margaretae personata*.

ACKNOWLEDGMENTS

Thanks to Matthew Bonnett and Adam Yates for the original report and the former for word processing. Also Anthony Pietsch for assistance and photography, Brian Miller for information and Dr Mark Hutchinson of the SA Museum for advice on identification and comments on the manuscript.

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Figure 1. *Egernia margaretae personata* photographed at Mootwingee N.P.

MISCELLANEOUS HERPETOLOGICAL FIELD NOTES FROM NORTH QUEENSLAND

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During 1992/3 I was employed as a consultant under a grant from the National Rainforest Conservation Program which was also supported in part by the Queensland National Parks and Wildlife Service.

In addition to information gained during this survey and published elsewhere, other data was accumulated. This paper presents some of these.

LACE MONITOR *VARANUS VARIUS* FEEDING HABITS

"Tex" Simmons was working on a pump in Myrtle Creek in the Proserpine area. He was up to his neck in water and diving under repeatedly when he observed a V-wake heading towards him. Because salt water crocodiles are regular inhabitants of this creek he vacated the water quickly.

From the bank he observed a lace monitor surface, climb a partly submerged log and proceed to eat a live fish it had apparently caught. It then dived again, caught another fish and ate it at the same emergent log.

Several fishermen in this region have recounted similar feeding habits in *Varanus varius.*

RANGE EXTENSIONS

The following range extensions are based on those distributions given by Cogger 1992.

1. *Litoria infrafrenata,* found 5km due east of Proserpine and has also been found in reasonable numbers at several different locations around Airlie Beach, Cannonvale and Shute Harbour. Previously known only from north of Townsville to Cape York it was initially thought that the first specimen collected in this region had possibly been introduced on a farm or similar truck. Checks confirm that this species has been known from the area for over 30 years (D. Moore, *pers. comm.*), and is known to breed here, which is supported by the numbers of sub-adults so far found. Apparently it has been overlooked by locals and mistaken for the more common *Litoria caerulea.* In view of the number of sightings, the large distribution range in this area, and the inherent problem that this species requires external fertilisation (hence a chance introduction of both a male and female at the same locale), it seems unlikely that these records represent a chance introduction to the Whitsunday region. This discovery has significant Bio/Paleo-geographic implications.

2. *Pseudophryne coriacea,* from Finchatton Gorge, Eungella National Park. Found calling about 100 metres away from the National Park boundary in a seepage area at the roadside, but would undoubtedly be found in suitable habitat within the park. These specimens are more typical of the smaller morph. found in the Border Ranges, than specimens further south. Currently the distribution is given as extending as far north as approximately Rockhampton, some 500km south of this new record.

CALL STRUCTURE OF *TAUDACTYLUS LIEMI*

Liem (1973) describes the call of *Taudactylus eungellensis* as being "high pitched metallic tinkering noise, which sounds like a little hammer tapping a metal plate repeated 4-5 times in quick succession". Cogger (1992) quotes this statement.

In fact the call thus described is that of *T.liemi.* K. McDonald, who is probably one of the few people who has heard, or indeed is likely to hear, *T.eungellensis* describes its call as a very quiet, low trilling, inaudible at more than a couple of metres.

T.liemi calls vary between one and six "hammer" beats, although five appears to be the more usual. No quantitative analysis was made. A sonargram of *T.liemi* is shown in Figure 1.

ACKNOWLEDGEMENTS

B. Heinrich, K. McDonald, B. and D. Moore, and "Tex" Simmons all contributed field observations and history, G. Richards prepared the sonargram.

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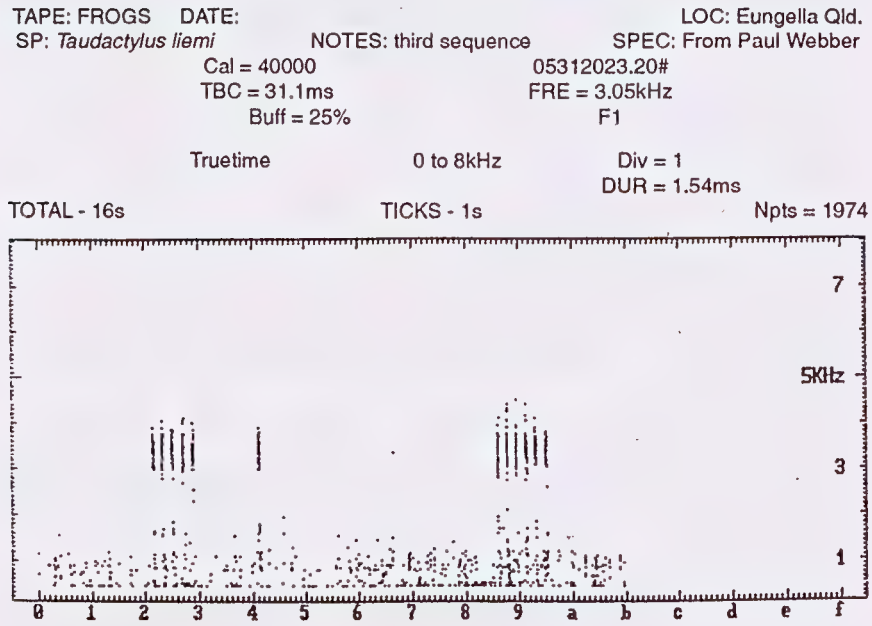
Figure 1. Sonargram of *Taudactylus liemi* call.



HERPETOLOGICAL NOTES

A RECORD OF THE WARTY SWAMP FROG, *LITORIA RANIFORMIS* FEEDING UNDERWATER

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On 5th May 1993 three specimens of the Warty Swamp frog *Lt. raniformis* were received by the Australian Museum. One sickened and died in the first two days but the other two have thrived. The larger of the two a male had rapidly learned to take food from forceps which made feeding dead food (thawed, frozen) easier and food wastage minimal. The author had suspected that *L. raniformis* might be capable of aquatic feeding so on 15th June 1993 when some fresh grasshoppers were obtained and the frog was hungry an opportunity presented itself to test this. The members of the *Lt. aurea* complex tend to be very shy and quick to take flight so when the container was opened to offer a grasshopper the frog hid below the water's surface under a piece of bark with its head exposed. A grasshopper was held in forceps and moved near the frogs head below the water level. The frog immediately lunged at it with an open mouth and water inhalation similar to the method used by *Cyclorana platycephala* (Robinson and Cappo, 1990). It missed on the first attempt but got it on the second and began to swallow it under water finishing with its head above water. The following day a mealworm beetle was offered to the same frog. The frog had its head above water while the beetle was 1cm below. The frog ducked its head under water and snatched the beetle from the forceps. These are the only two aquatic feeding attempts the author has observed but although capture and ingestion has not been witnessed both *Lt. raniformis* individuals seem to eat any water snails placed in with them. The empty shells are usually found a day or two later. It is possible that all species in this complex can feed under water but this needs to be tested. Robinson and Cappo (1990) record aquatic feeding in *Lt. dahlii.*

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EYE PROTECTION DURING BASKING BY AN ALBINO OLIVE PYTHON *(LIASIS OLIVACEUS)*

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An albino Olive Python *(Liasis olivaceus)* was found in March 1993 at a mine site, 80 kilometres south of Darwin (Herp. Review. submitted September 1993). This animal is typical of an albino in having pink eyes and tongue, creamy white dorsal surface and snow white ventral surface. The animal is approximately 1.5 metres in length and has adapted readily to a captive environment.

The animal is housed in a large aquarium (800x400x500mm) in the science laboratory at the Northern Territory University. This cage has a wooden lid with numerous holes drilled into it.

This lid has a 75 watt globe (Osram, Australia) for heat in one corner and a UV blacklight across the rear. These lights are attached to a Honeywell airconditioner thermostat which is set at 30°C. It is possible for the snake to bask and achieve a body temperature above the thermostat setting. On one occasion the core body temperature of this albino snake was 34.5°C. A small cardboard box provides a hide and food and water is provided each Monday. The lights are on a timer to give a photoperiod of 14L:10D.

When this animal was placed in the heated cage it spent the first week in the hide box and was only active at night when the lights went out. Room temperature increased in the laboratory at night as the airconditioner went off. The room temperature was found to be about 27°C at night and 23°C during the day. After the first week the snake began spending more and more time under the heat lamp. It was during this time that it was noticed that the animal coiled loosely but its head was never visible. In fact the head was always placed under a coil in what could be considered a protective measure. Due to the lack of pigment in the eye of albino animals it has been held that bright light is painful for them. When the snake had its head under a coil while basking and it was touched it would jump as if startled and spend some time tongue flicking and moving its head to discern the interruption. After 5-10 minutes it would settle down and return to basking with its head firmly tucked under a coil.

SUCCESSFUL TREATMENT OF A DIAMOND PYTHON *(MORELIA SPILOTES SPILOTES)* WITH CELLULITIS

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A male diamond python in my collection recently developed an acute case of cellulitis.

The cause is still unknown and the signs appeared overnight. The python is a long term captive that has never had any health problems previously. The snake developed a gross swelling of the tissue on the underside of the head from the apex of both sides of the lower jaw to the front of the mouth also affecting the gums and lips but not the top of the head. The swelling was so great that the snake could not close its mouth. On examination no lesions could be discovered in the mouth and the tongue still reacted normally. A course of antibiotics was commenced. Fortum (ceftazidine 20mg/kg) was chosen. A course of three injections was given, one every 72 hours at a dose rate of 2ml per kilo. PredX, an anti-inflammatory steroid, was also given at two 0.5ml intramuscular injections 24 hours apart. At the completion of the treatment no improvement was observed.

I decided to offer the snake a dead rat (not really expecting it to eat). The snake accepted the rat even though manouvering was clumsy. As usual with pythons the cream ventral side of the throat turned a pink colour indicating an increase in blood flow to the area. Immediately after swallowing the rat I noticed that the swelling had reduced by about 30%. There was no further improvement over the next four days. I then offered the python another large dead rat which it took about 30 minutes to consume. On completion of the meal all swelling had disappeared. The head had returned to normal dimensions and at the time of writing the snake appears healthy.

The swelling was probably due to oedema - a build up of extracellular fluid. Pressure on the tissues of the head due to passage of food past them may simply have squeezed out the fluid, which would be drained away from tissues by the lymphatics.

ACKNOWLEDGMENT

Thanks to Glenn Shea for his comments.

UNUSUAL BEHAVIOUR OF GRASS SKINKS *(LAMPROPHOLIS DELICATA)*

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Grass skinks *Lampropholis delicata* occasionally fight (pers. obs) and this consists of lizards biting and twisting (see figure 1). Recently at Nowra two skinks were observed displaying unusual behaviour.

One skink was chasing another when the animal being chased stopped, looked at the aggressor and began to move its back legs in a slow walking motion. This lizard remained still except for the back legs making the slow walking motions. The lizards were approximately 200mm apart and when the aggressor moved closer to the 'pacing' skink both animals moved off.

Eulamprus quoyii have been observed using their legs to visually communicate to conspecifics (Daly, in press) and this behaviour in *L.delicata* could also be a form of visual communication.

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Figure 1. *L. delicata* fighting.

PYTHON KILLS PELICAN

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While camped at Muirella Park campground in Kakadu National Park on the 26th of June, 1992 a friend and I decided to take a late afternoon walk on the Bubba wetlands walk. When we arrived at the billabong (12°52' 132°45') we rested at the edge of the wetland and observed the waterbirds on the water. These included the great egret, little egret, green pygmy goose, wandering whistling duck, australasian grebe, little pied cormorant, little black cormorant,

comb-crested jacana, darter, brolga as well as two australian pelicans which were floating around in the middle of the billabong about 80m out from where we were sitting. Occasionally, they would dip their heads and bills under the water as they foraged for fish.

It was around 5.30 pm when I noticed one of the pelicans struggling to get its head out of the water, when it did, it had a python coiled around its neck (at least two coils were observed). The python when viewed through a pair of Nikon 10 x 25 binoculars, was approximately 5-6 cm in diameter. The pelican couldn't keep its head above water with the weight of the python combined with the constriction of the coils. The pelican struggled for over 5-10 minutes after which no sign of life was evident. It either drowned because it could not keep its head above water or was asphyxiated by the python's contractions, or both. The python made no attempt to eat the pelican as far as we know. When we left about 15 minutes later, just on dusk the pelican was still floating on the water with its wings outstretched and its head submerged. The other pelican, which had witnessed the incident without appearing to be alarmed (i.e. it did not move off), was still paddling about nearby.

The identity of the python is not known, it was too far off and seen too briefly to be identified. However, it is probable that it was a water python *(Liasis fuscus)*. Water pythons are semi-aquatic in habit and frequent the freshwater wetlands and waterways of northern Australia (Shine 1993, Wilson and Knowles 1988, Cogger 1986). Birds including waterbirds form a large part of the diet of the water python (Shine 1993). An adult water python has been observed capturing and eating a masked lapwing (Shine 1993).

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BOOK REVIEW: THE HERPETOFAUNA OF THE WEIPA REGION, CAPE YORK PENINSULA

The Herpetofauna of the Weipa Region, Cape York Peninsula, by E.E. Cameron and H.G. Cogger is Technical Reports of the Australian Museum Number 7. It is one of a series of occasional papers produced by the Museum which include bibliographies, catalogues, surveys and data bases in the fields of anthropology, geology and zoology.

This report, funded by Comalco Mineral Products, consists of an annotated list of the frogs and reptiles recorded in the Weipa region, based around six visits made to the area by Australian Museum staff between 1977 and 1982. It also includes historical records and data recorded from private individuals and other surveys carried out in the same period. These include Queensland National Parks and Wildlife Service and the private companies Biological Environmental Research Services and Reeders & Morton. The report is more than an annotated list in that it has a structured format that would enable a user working in the Weipa region to use the report as a field guide. The text for each of the twenty one species of amphibians and 76 species of reptiles not only includes a detailed description of the animals but information on distribution at Weipa and geographic range; survey and overall abundance; biological data on habitat; reproduction and seasonality; notes where any other information is included on behaviour, reproduction, sex ratios, food preferences and descriptions to help identify it from similar species; and references to detailed information for each species. Also included with the text for each species is a line drawing map of the area with point locations for specimens recorded; any variation in nomenclature which appear in other literature; and information on toxicity.

Photographs in colour or black and white for all but three species and some habitat scenes are incorporated, three per page, and are of excellent quality and include detailed and comparison illustrations where needed. To complete the identification package, a key has been provided to assist workers restricted to the Weipa area. One point that may have made the key more useful would have been the inclusion of the species not recorded in this report but listed in Appendix 5 as being likely to occur in the Weipa region based on predicted occurrence.

The report commences with a description of the Weipa region; the habitats; history; impact of humans and feral animals and a discussion on previous studies of the region before the annotated list. This is then followed by chapters on composition; abundance; seasonal activity and reproduction; habitat preferences; biogeography; and issues concerning conservation. A very useful chapter then follows reporting the arrival of the Cane Toad in the Weipa region. The major reason for this survey was to record the herpetofauna before the arrival of Cane Toads. Commencing in July, 1977, the first toad was recorded at Weipa airport in June, 1979. This report is therefore one of the few opportunities to document contemporary lists of animals from an ever decreasing source of toad free areas within their potential distribution and for this reason alone, stands as a valuable document for future reference. Effects of habitat modification, referring to regenerated mine areas; how data from this survey contributed to other projects; and a summary complete the main text.

Other appendices include a list of survey periods and the staff who participated; descriptions of the 53 survey sites; species recorded; summary of specimen and sight records; first aid for snakebite and frog toxins; a seasonality table; distribution among habitats; a comparison of size to other northern Australian herpetofauna populations; geographic affinities with other regions; and a list of the stomach contents from a sample of Cane Toads.

This survey report fills a gap in the knowledge of the herpetofauna in the remote and poorly known regions of tropical northern Australia. This is emphasised by the discovery and inclusion of 2 undescribed species of reptiles and doubt about the identity of a frog species. Although limited as a general text on frogs and reptiles it is a very thorough document for the area it encompasses. Printed on high quality paper and spiral bound, this 200 page report is not available by subscription but is distributed to scholarly institutes and copies can be obtained from the Australian Museum for $41.00 ($43.50 posted).

John Wombey

BOOK REVIEW

Smuggled. The Underground trade in Australia's Wildlife. 144pp. by Raymond Hoser. Published by Apollo Books. Price $18.95.

The book contains a foreword, preface and introduction, and fifteen chapters covering: who wants our wildlife, types of wildlife smuggling (official, retail and private), detection of smugglers and smuggling activities, the role of wildlife authorities, the fauna squad, zoos and other institutions, the Mafia's involvement, the smuggling inquiry, the American scene, smuggling rackets in other countries, stopping the illegal trade in live wildlife, saving our native animals and the future, and a selected bibliography. There are twenty eight black and white photographs.

I believe the publishers have done the author a disservice by not providing editorial discipline and good layout. The random scattering of newspaper clippings through the book without any reference to the text is irritating, the photographs do not appear to serve any useful purpose and the author has adopted a rather scattergun approach to the subject. All of these could have been dealt with and improved by editorial staff.

The authors definition of smuggling I found to be very liberal which no doubt explains the large sections of the book dealing with prosecutions for having protected fauna and similar events which on the face of it appear to have little in common with the "import or export of goods across international boundaries in contravention of law."

The bringing together of events and cases covering the last 25 years into the one volume is useful. But has the book shed any new light on smuggling? I have to admit I am no wiser. There are a lot of suggestions on who may have been involved in the past as well as presenting instances of those who were involved and convicted. Too often however there is just an allegation that officials, members of parliament or other persons in positions of authority were involved. But no names and hard evidence.

My real concerns with the book are the inaccuracies that I found and those that others have found. In a review of the book for the Australian Birdkeeper, Michael Schooley says "...an article that appeared in the Pix Magazine in 1970. Raymond says according to journalist Dick Wordley at least six men had 'gone down' in eight months in lobster pots behind Sydney Heads after they had been chopped up. This was a story that was given by a senior Customs Officer at a lecture in South Australia. Dick was in the audience, as at the time, he was the Press Director of the National Parks and Wildlife Foundation in Australia. This was reported as told by a Customs Officer who was later interviewed by the Homicide Squad in Sydney after it appeared in the Magazine. The Officer admitted it wasn't true." If Schooley's version is correct it indicates the author has not done thorough research. Accepting articles in the tabloids at face value is an act of tremendous faith, akin perhaps to walking on water.

On page 73 under the heading of Misinformation the author presents the case of Peter Jones and his dealings with authority in Wanaaring, NSW. Jones called in at the police station on the afternoon of his arrival and advised the police officer of his intentions. That evening he found *Diplodactylus conspicillatus* and several other species of gecko, and retained these to photograph the next day. Early next morning he met the police officer again on the road outside Wanaaring and told him that he had been successful in finding the species. He then drove into Wanaaring to refuel and while there was approached by the same police officer and a National Parks ranger. The epilogue is more involved than reported by Hoser. Peter Jones is adamant that the author never discussed this incident with him, so where did he get his information particularly the first person conversations?

On page 4 of the introduction it is stated that "A Reptile Keepers Association (RKA) had already formed in New South Wales to fight smugglers who broke into people's houses and took reptiles for smuggling purposes." This was not the reason the RKA was formed nor did it ever form a part of the RKA objectives.

While any book will contain errors and mistakes honestly made, the problem I have with this book is how much of the material presented is truly factual and how much is unverified rewrites of newspaper reports or conversations with third parties. Poetic licence is accorded to authors but too much makes fiction out of fact.

While not a 'herp' book in the true sense it will be of interest to many reptile keepers because it does provide a concise reference to many of the cases/incidents of the past 25 years that at present are part of the anecdotal heritage of reptile keeping. It also raise questions as to the true nature of wildlife authority activities in some areas, and while ignorance and bureaucratic stupidity account for much of the 'corruption' there is a real need for the whole question of political involvement and interference in wildlife conservation to be addressed. Yes it is worth buying because there are lots of interesting little pieces between the covers and because the author is trying to focus attention on a problem area and one in which a lot of people assume, quite reasonably, a considerable amount of covering up has been going on.

Gerry Swan

Herpetofauna incorporates the *South Australian Herpetologist* and the *Bulletin of Herpetology* and is published twice yearly by the Australasian Affiliation of Herpetological Societies. The Affiliation started on an informal basis in 1974 and was formally established in 1977. It is the result of a formal agreement between member societies to participate in cooperative activities.

The Affiliation's objectives are to promote the scientific study of amphibians and reptiles and their conservation, to publish the journal *Herpetofauna,* to encourage liaison between member societies at the Regional level. It is not intended to be a separate society, nor is it to deplete member societies of their vital expertise and resources.
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HERPETOLOGICAL NOTES

ISSN 0725-1424
Printed by Acme Office Service Pty Ltd
Unit 7, 2 Cambell Street Artarmon NSW 2064. Telephone: (02) 436 1544